



PRELIMINARY

PROPERTY of SIGMETICS  
INSTALLATION AND OPERATION  
INSTRUCTIONS S/N 155  
CALIBRATION LABORATORY  
4200 SERIES DIGITAL VOLTMETERS

non-linear systems, inc.

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non linear  
 systems, inc.

DEL MAR, CALIFORNIA

MP MASTER



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#### NOTE

This manual contains drawings  
applicable to instruments with  
Serial Number 150 and on.

At serial no. 150, new drawing numbers were given to certain plug-in circuit boards which contained non-interchangeable changes made at or before serial no. 60. However, all new plug-in circuit boards used at serial no. 150 are interchangeable with corresponding boards used between serial no. 60 and 149. No changes were incorporated between serial no. 60 and 149.



## INTRODUCTION

NLS 4200 Series Digital Voltmeters are all-electronic successive-scan instruments. Decades are scanned, or sampled, in a definite sequence starting with the left-hand decade and progressing to the right.

These instruments provide a high common-mode rejection capability which is in large part due to their case-within-a-case construction which shields the input signal low from the outer wrap-around. With this type of construction, a ground isolated differential input can float up to 500 volts from the wrap-around, or chassis, ground. In addition, these instruments provide full four-digit resolution and 10-megohm input impedance.

The speed of the 4200 Series instruments, depending upon range changes required, will vary from 50 to 150 milliseconds per reading. Automatic polarity changes will not affect the speed. Range changes occur when the previous measurement is not within the proper range for the new measurement; that is, the range changes only when required. Unlike many other instruments, the 4200 models do not revert to the lowest range between readings.

Since 4200 Series instruments are available in a number of models, an instrument may be selected to meet the needs of a particular application. Those models which provide decimal voltage level outputs are capable of matching or exceeding the maximum speed capabilities of most electro-mechanical data



printers and punches. The various models in the 4200 Series are here listed:

| MODEL | NUMBER OF |        | FUNCTION CONTROLS |       |       |        |
|-------|-----------|--------|-------------------|-------|-------|--------|
|       |           |        | POLARITY          | RANGE | PRINT | REMOTE |
|       | DIGITS    | RANGES |                   |       |       |        |
| 4201  | 4         | 1      | A                 | F     |       |        |
| 4202  | 4         | 1      | A                 | F     | DVL   | YES    |
| 4203  | 4         | 3      | A                 | M     |       |        |
| 4204  | 4         | 3      | A                 | AM    | DVL   | YES    |
| 4205  | 4         | 3      | A                 | M     |       |        |
| 4206  | 4         | 3      | A                 | AM    | DVL   | YES    |

A = AUTOMATIC

DVL = DECIMAL VOLTAGE LEVEL

F = FIXED

AM = AUTOMATIC AND MANUAL

If additional information is needed, please contact the nearest NLS office, or contact the main office at Del Mar, California.



## II SPECIFICATIONS

**Ranges:**  $\pm 9.999/99.99/999.9$  volts. Consult NLS regarding voltage ratio measurement.

**Readout:** 4-digit, in-line, NLS dot-engraved, edge-lighted, plastic plate type for high contrast and low eye fatigue.

**Polarity Selection:** Automatic, Polarity change does not affect measurement speed.

**Range Selection:** Combination of automatic, fixed, manual, and remotely programmable, depending upon model. Remote selection requires a 1-pole, 4-position switch in Model 4206, and a 2-pole, 3-position switch in Model 4204.

**Speed:** Without range change: 50 millisec/reading change (polarity included) not involving a range change. When making repetitive measurements in auto range mode, range changes only when input voltage falls outside of the range in use. With range change: 100 millisec/reading (10 readings/sec.) for readings requiring one range change. 150 millisec/readings in two range changes. Range changing



Speed (cont'd): sequences: low-middle-high, high-middle-low, middle-high and middle-low.

Logic: Scan type measurement times listed are constant.

Start Trigger: A manual, remote (-12 volt pulse), or internally clocked (20/sec) "scan-trigger" starts each measurement.

Accuracy:  $\pm(0.02\% \text{ of full scale} + 1 \text{ digit})$ .

Resolution:  $\pm 0.01\% \text{ of full scale on each range}$ .

Input Impedance: 10 megohms. Impedance may drop to 1 megohm if input voltage exceeds range selected.

Digital Outputs: Decimal (10-line/decade) or BCD (1-2-4-2 code) voltage levels are available in models having "record" features. True = 0 volts; False = -12 volts. For other code options, consult NLS.

Common Mode Rejection: Case within-a-case construction and well-shielded power transformer are used to obtain high common-mode-rejection and ground isolation. The instrument rejects AC common-mode noise by at least 60 db at 60 cps.

Primary Power: 115, -10 volts, 60 cps; approx. 60 watts. 230 VAC may be used if power transformer primaries are wired in series as shown in Schematic Drawing No. 42-62 Sheet 3.



- Dimensions: 5 $\frac{1}{4}$ " high, 19" deep (not including connectors), for mounting in standard 19" wide rack or for bench use.
- Construction: Plug-in printed circuits mounted on 3/32" epoxy fiberglass circuit boards.

Specifications are subject to change without notice.



### III

#### INSTALLATION AND OPERATION

##### UNPACKING

Instruments are shipped in corrugated containers. The interior contains four polystyrene corner pieces which support the instrument. The instrument itself does not contain any packing material and is ready for operation as received. It is suggested that the container be saved if the instrument is to be shipped at a later date or if it is to be stored. If damage is seen, promptly notify the carrier.

##### POWER SOURCE

The instrument is usually furnished for operation from conventional 115-volt, 60 cycle power sources. A 230 volt AC source may be used if the two primaries of the power transformer are wired in series. When making this change, keep in mind that the cooling fan is rated at 115 volts AC and must be paralleled with one winding of the power transformer pin connections when adapting the instrument to 230-volt operation. Drawing No. 42-34 shows how to modify the instrument for 230-volt operation.

##### POWER GROUNDING

The third pin on the power plug grounds the outside chassis of the instrument. The internal case of the instrument, hereafter referred to as "guard" shield, is isolated from the power source and from the outer chassis ground.



## INPUT CONNECTION

The instrument is equipped with two binding posts on the rear panel. The red connector is signal high; the black connector is signal low. The black connector is not electrically connected to the panel or to the outer chassis of the instrument but ties directly to the guard shield. Potentials up to 500 volts may be tolerated between the outer chassis (which is also AC line ground) and the inner guard shield (which is signal low).

## CONTROLS

All models within the 4200 Series have the same front panel arrangement; however those functions which are not within the capability of any specific model are mechanically and electrically locked out of operation. Check the list of models in the Introduction to establish which of the following functions are provided with any particular instrument:

The POWER switch has three settings:

OFF -- The instrument is de-energized and both power leads are isolated from the power source; however connection is maintained between the outer case and AC power line ground.

ON -- In this position the instrument is ready to provide readings. For maximum specified accuracy, a warm-up period of 30 minutes is recommended.

RECORD -- This position is used to operate external printers and punches. In models not providing an external output



Record -- this position is locked out.  
(cont'd)

The RANGE switch has five positions:

REMOTE -- This position allows control of the other four positions of the RANGE switch from a remote switching circuit which is connected to the 75-pin connector at the rear of the instrument. Connection points are shown in the remote Range Switch Wiring Diagram. The REMOTE setting is locked out of instruments not equipped for remote operation.

10V, 100V, 1000V -- These positions are used to fix the maximum voltage which will be read. When these maximums are exceeded, the instrument will display all nines. Up to 1100 volts may be applied to any range without damage.

AUTO -- This position causes the instrument to select automatically the appropriate range for the input applied. In models not providing an auto-range capability, this position is locked out.

The TRIGGER switch has four positions:

CONT. SCAN- This position allows the instrument to operate at the full rated speed and to change its display at the maximum specified rate in the presence of a varying voltage. Also, an unchanging input will be scanned at the maximum rate.



EXT. TRIGGER -- This position allows the instrument to make only one computation and arrive at one reading which is held until an external command is applied (through the 75-pin connector at the rear of the instrument) to "tell" the instrument to compute and display one more time. This position is often used to synchronize the speed of a printer or punch (equipped with appropriate contact closures) with the digital voltmeter. See drawing 42-53 for triggering information.

STANDBY -- When the TRIGGER switch is set at STANDBY, the starting circuits cannot be triggered, and therefore the instrument can make no measurements.

SINGLE SCAN -- If the TRIGGER switch is turned to the SINGLE SCAN position, the instrument will make a single scan, or measurement. There is no detent in the SINGLE SCAN position, and a spring returns to the TRIGGER switch to the STANDBY position upon release of the knob. Before each measurement made in the single scan mode, the TRIGGER switch must be allowed to return to STANDBY. The operation of the starting circuits in SINGLE SCAN is the same as for EXTERNAL contact closure.



## IV CALIBRATION

When a 4200 Series Instrument is not making readings within specifications, it is time for calibration, repair, or both. In the calibration information given in this section, it is assumed that the instrument is in good working order and only requires calibration. If any components are defective, it may be difficult, if not impossible, to calibrate the instrument properly.

The calibration procedure is divided into three distinct areas: absolute accuracy adjustment, polarity balance adjustment, and ranging adjustments. It is important to adjust the instrument by following the steps in their numbered sequence. Figure 4-1 shows the locations of all adjustment potentiometers.

### Equipment Needed

1. Stable sources of 9.500 - 9.999, 95.00 - 99.99, and 950.0 - 999.9 volts DC. It is not necessary that the precise values of these voltages be known; the only requirement is that they fall within the specified range and are stable.
2. A ratio box with precise divisions of 10:1 and 100:1, such as the NLS P/N 3020.
3. A bank of nine standard cells, such as the NLS P/N 3006, which provides 9.16XX volts.

### STEPS

#### Absolute Accuracy Adjustment

1. Turn on the digital voltmeter and allow it to warm up for 30 minutes.



2. Set the RANGE switch at AUTO, the TRIGGER switch to CONT. SCAN.

3. Connect the standard-cell bank (Item 3 under Equipment Needed) to the input of the instrument; black to negative, and red to positive.

4. The display should read correctly the certified value of the standard-cell bank. If it does not, adjust R23 until the display reads the correct value. When adjustment is made, remove the standard-cell bank from the instrument leads.

#### Polarity Balance Adjustment

5. Connect a stable source of 9.500 - 9.999 to the input of the instrument (Item 1 on Equipment Needed list). Note the value indicated on the display.

6. Reverse the polarity of the input applied in Step 5 and observe that the value is exactly the same, but in the opposite polarity. If the digits displayed in Step 5 are not the same as in this step, adjust R-64 until the readings agree in both polarities. Adjustment may be made while the display reads in either polarity.

7. Since there is interaction between the adjustment of R-64 and R-23, repeat Steps 3,4,5,6, and, if necessary, Step 7.

#### Ranging Adjustment (100 Volts)

8. Connect the input terminals of the digital voltmeter to the output of the ratio box (Item 2 in Equipment Needed list).

9. Set the ratio box at 10:1 and apply a stable source of 95 to 99 volts to its input. Record the value of the display.



10. Remove the input leads of the voltmeter from the output of the ratio box and connect them to the input. Record the value of the display.

11. If the readings taken in Steps 9 and 10 are the same except for decimal-point position, the 100-volt range is correctly adjusted. For example, if the reading in Step 9 was 98.76, then the reading in Step 10 should be 9.876. If the readings are not correct, adjust the 100-volt range potentiometer, R-47.

#### WARNING

The following steps require the use of dangerously high voltages. Be careful!

#### Ranging Adjustment (1000 Volts)

12. Connect the input terminals of the digital voltmeter to the output of the ratio box.

13. Set the ratio box at 100:1 and apply a stable source of 950 to 999 volts to its input. Record the value of the display.

14. Remove the input leads of the voltmeter from the output of the ratio box and connect them to the input of the ratio box. Record the value of the display.

15. If the readings taken in Steps 13 and 14 are the same except for decimal-point position, the 1000-volt range is correctly adjusted. For example, if the reading taken in Step 13 was 9.876, then the reading in Step 14 should be 987.6. If the readings are not correct, adjust the 1000-volt range potentiometer, R-49.



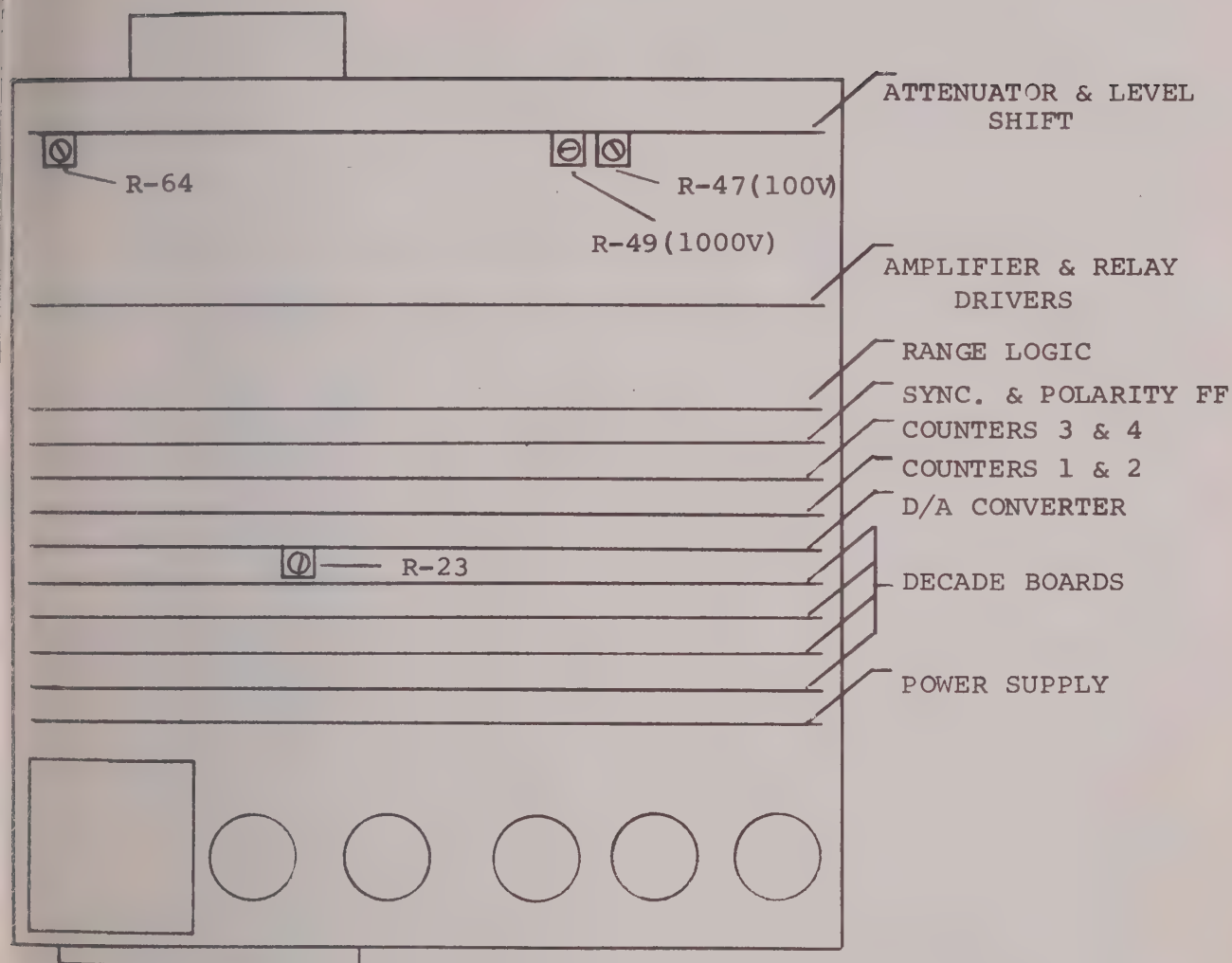


FIGURE 4-1. Front Top View of 4200 Digital Voltmeter  
Showing Adjustments and Board Locations



## MAINTENANCE

If a 4200 Series Digital Voltmeter is not working properly, or if it cannot be calibrated according to instructions, service will be required.

Before seeking out specific defective components, it is best to establish that the several power supplies are working. Specifically, voltage checks should be made at the voltage output points of the power supplies as indicated on the schematic drawings. A simple 20,000 ohm-per-volt d'Arsonval type meter may be used for these measurements. The voltage measurements should indicate correct values  $\pm 15\%$  when read on a voltmeter with a rated accuracy of  $\pm 3\%$ . The outputs of the regulated power supplies cannot be accurately read by this method, but in practice the accuracy of their outputs need not be known; if a regulated power supply fails, it is most likely that the voltage error will be gross (or there will be no output at all) and therefore detectable with simple measuring instruments.

If a measured voltage appears to be at an improper value, the associated power supply components should be checked; if none of these are found to be defective, it will be necessary to proceed along the defective power path, checking wiring, connectors, printed circuitry, and finally components on the boards. An obvious way to make a speedy check is to replace suspected defective boards with known good ones. Since the decade boards are all interchangeable, a malfunction affecting one decade of the readout



can be made to affect other decades. For this reason, it is suggested that<sup>a</sup> trial and error approach be used and the decade boards be interchanged. If the malfunction then manifests itself in a previously unaffected decade, the defective board can be readily isolated. From this point on, a test of components will locate the precise area of failure.

It is suggested that the block drawings in this manual first be consulted, and then the individual schematics be studied so as to better know what outputs may be expected at each function.

When testing for the presence of an output, bear in mind that there are timing relationships and that if an expected output is missing, the instrument's flip-flops may be in a state which nulls a particular value which is being sought.



The following table lists specific types of malfunction.

Note that any of dozens of components could fail and yet the symptom would be the same for all, there is no one component which can readily be singled out as a consistent offender. For this reason, the most useful approach to trouble-shooting is to provide a list of possible types of failure and identify the plug-in board or circuit area most likely to contain the defective component.

| <u>SYMPTOM</u>                                                                        | <u>PROBABLE DEFECTIVE BOARD</u>                                                      |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Readout locks on 9 in a given decade                                                  | D/A Converter                                                                        |
| Polarity lights are out or are incorrect.                                             | Sync, Polarity FF                                                                    |
| Decimal lights are out or are incorrect.                                              | D/A Converter                                                                        |
| Multiple lights appear in one or more decades.                                        | Sync, Polarity FF<br>Counters 1 & 2<br>Decade                                        |
| A particular digit fails to illuminate.                                               | Bulbs<br>Decade                                                                      |
| Readout illuminates, but instrument does not scan.                                    | Counters 1 & 2<br>Sync, Polarity FF<br>Power Supply<br>Counters 3 & 4<br>Range Logic |
| Readout is locked at 9999, or is unstable and seeks 9999 regardless of input voltage. | Amplifier<br>Counters 3 & 4<br>-20V Precision Supply<br>or +24V                      |
| Readout displays 9999 in one polarity, but not in other, regardless of input voltage. | Sync, Polarity FF<br>Amplifier<br>Attenuator                                         |



| <u>SYMPTOM</u>                                                                                 | <u>PROBABLE DEFECTIVE BOARD</u>                                       |
|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Instrument scans when<br>MODE switch is at STANDBY                                             | Counters 3 & 4<br>Sync, Polarity FF                                   |
| Instrument skips digits, or<br>has "holes" in decades.<br>Transfers and linearity are<br>poor. | D/A Converter<br>Counters 1 & 2<br>Decade                             |
| Readout shows only certain<br>numbers in decades                                               | Decade<br>D/A Converter                                               |
| Instrument reads correctly in<br>one polarity, but loses digits<br>in the other.               | D/A Converter                                                         |
| Readout illumination is dim.                                                                   | -20v Precision Supply                                                 |
| Readout displays erroneous values<br>which are somewhat proportional<br>to the input voltage.  | Voltage Reference Supply                                              |
| Readout Display is consistently<br>higher than the input voltage.                              | Voltage Reference Supply,<br>or Input Attenuator,<br>or D/A Converter |
| Readout "sticks" on particular<br>numbers.                                                     | Decade                                                                |



# PARTS LIST

| Part Number | Description                            | Quantity<br>per Instr. | Manufacturer |
|-------------|----------------------------------------|------------------------|--------------|
| -2          | Power Supply                           | 1                      | NLS          |
| -5          | Decade                                 | 4                      | NLS          |
| -8          | D/A Converter                          | 1                      | NLS          |
| -11         | Counter 1 & 2                          | 1                      | NLS          |
| -14         | Counter 3 & 4                          | 1                      | NLS          |
| -17         | Sync. Pol. F-F                         | 1                      | NLS          |
| -20         | Range Logic                            | 1                      | NLS          |
| -23         | Amplifier and Relay Drivers            | 1                      | NLS          |
| -26         | Attenuator                             | 1                      | NLS          |
| 02          | Main Board                             | 1                      | NLS          |
| 36          | Resistor Board                         | 1                      | NLS          |
| 0-44        | Readout, 4-W Type                      | 1                      | NLS          |
| 0-43        | Readout, 4-W Type                      | 4                      | NLS          |
| 349         | Capacitor, 180 $\mu$ fd/200 v          | 2                      | IND. COND.   |
| x254K       | Capacitor, .25 $\mu$ fd/100 v          | 1                      | ELPAC        |
| 02          | Capacitor, .001 $\mu$ fd/1000 v/10% 60 |                        | CRL          |
| X105        | Capacitor, 1.0 $\mu$ fd/100 v          | 2                      | ELPAC        |
| J103J       | Capacitor, .01 $\mu$ fd/100 v/5%       | 3                      | ELPAC        |
| 756         | Capacitor, 2 $\mu$ fd/100 v/20 %       | 1                      | ELPAC        |



| Part Number | Description                                     | Quantity<br>per Instr. | Manufacturer  |
|-------------|-------------------------------------------------|------------------------|---------------|
| 473K        | Capacitor, .047 $\mu$ fd/200 v                  | 2                      | ELPAC         |
| 245RRK      | Capacitor, 2000 $\mu$ fd/50 v                   | 2                      | IND. COND.    |
| 246RRK      | Capacitor, 4000 $\mu$ fd/25 v                   | 3                      | IND. COND.    |
| TV500       | Capacitor, 500 $\mu$ fd/50 v                    | 1                      | IND. COND.    |
| A105        | Capacitor, 1 $\mu$ fd/200 v                     | 1                      | ELPAC         |
| 37          | Diode                                           | 14                     | G.E.          |
| 40          | Diode                                           | 4                      | G.E.          |
| 124R        | Diode                                           | 2                      | TEXAS INSTRU. |
| 51A         | Diode, Zener, 5.1 v, 400 mw                     | 1                      | MOTOROLA      |
| 024B        | Diode, Zener, 15 v., 1 w 5%                     | 1                      | MOTOROLA      |
| aturi       | Fan                                             | 1                      | ROTRON        |
| 001         | Fuse, 3 AG, Slo-Blo, 1A                         | 1                      | LITTELFUSE    |
| 0:-1-203    | Potentiometer, 20 k $\Omega$                    | 3                      | BOURNS        |
| OP-1-202    | Potentiometer, 2 k $\Omega$                     | 1                      | BOURNS        |
| -1B         | Resistor, 100 $\Omega$ , 1 w, 1%                | 1                      | DALE          |
| 3           | Resistor, 6.19 k $\Omega$ , $\frac{1}{4}$ w, 1% | 5                      | I.R.C.        |
| 3           | Resistor, 6.81 k $\Omega$ , $\frac{1}{4}$ w, 1% | 1                      | I.R.C.        |
| 3           | Resistor, 13.0 k $\Omega$ , $\frac{1}{4}$ w, 1% | 1                      | I.R.C.        |



## PARTS LIST

| Part Number | Description                                  | Quantity<br>per Instr. | Manufacturer  |
|-------------|----------------------------------------------|------------------------|---------------|
| Commercial  | Resistor, 24 $\Omega$ , $\frac{1}{2}$ w, 5%  | 1                      | ALLEN BRADLEY |
|             | Resistor, 36 $\Omega$                        | 1                      | ALLEN BRADLEY |
|             | Resistor, 43 $\Omega$                        | 1                      | ALLEN BRADLEY |
|             | Resistor, 100 $\Omega$                       | 1                      | ALLEN BRADLEY |
|             | Resistor, 160 $\Omega$                       | 1                      | ALLEN BRADLEY |
|             | Resistor, 200 $\Omega$                       | 3                      | ALLEN BRADLEY |
|             | Resistor, 300 $\Omega$                       | 2                      | ALLEN BRADLEY |
|             | Resistor, 470 $\Omega$                       | 15                     | ALLEN BRADLEY |
|             | Resistor, 910 $\Omega$                       | 15                     | ALLEN BRADLEY |
|             | Resistor, 1 k $\Omega$ , $\frac{1}{2}$ w, 5% | 64                     | ALLEN BRADLEY |
|             | Resistor, 1.1 k $\Omega$                     | 1                      | ALLEN BRADLEY |
|             | Resistor, 1.3 k $\Omega$                     | 5                      | ALLEN BRADLEY |
|             | Resistor, 3 k $\Omega$                       | 109                    | ALLEN BRADLEY |
|             | Resistor, 3.9 k $\Omega$                     | 2                      | ALLEN BRADLEY |
|             | Resistor, 4.3 k $\Omega$                     | 7                      | ALLEN BRADLEY |
|             | Resistor, 5.1 k $\Omega$                     | 62                     | ALLEN BRADLEY |
|             | Resistor, 6.2 k $\Omega$                     | 4                      | ALLEN BRADLEY |
|             | Resistor, 6.8 k $\Omega$                     | 15                     | ALLEN BRADLEY |
|             | Resistor, 7.5 k $\Omega$                     | 2                      | ALLEN BRADLEY |
|             | Resistor, 8.2 k $\Omega$                     | 7                      | ALLEN BRADLEY |
|             | Resistor, 9.1 k $\Omega$                     | 2                      | ALLEN BRADLEY |



## PARTS LIST

| Part Number | Description                                   | Quantity<br>per Instr. | Manufacturer  |
|-------------|-----------------------------------------------|------------------------|---------------|
| Commercial  | Resistor, 10 k $\Omega$ , $\frac{1}{2}$ w, 5% | 4                      | ALLEN BRADLEY |
|             | Resistor, 11 k $\Omega$ ,                     | 2                      | ALLEN BRADLEY |
|             | Resistor, 12 k $\Omega$ , $\frac{1}{2}$ w, 5% | 6                      | ALLEN BRADLEY |
|             | Resistor, 13 k $\Omega$                       | 24                     | ALLEN BRADLEY |
|             | Resistor, 16 k $\Omega$                       | 13                     | ALLEN BRADLEY |
|             | Resistor, 18 k $\Omega$                       | 3                      | ALLEN BRADLEY |
|             | Resistor, 20 k $\Omega$                       | 119                    | ALLEN BRADLEY |
|             | Resistor, 22 k $\Omega$                       | 5                      | ALLEN BRADLEY |
|             | Resistor, 27 k $\Omega$                       | 35                     | ALLEN BRADLEY |
|             | Resistor, 30 k $\Omega$                       | 2                      | ALLEN BRADLEY |
|             | Resistor, 47 k $\Omega$                       | 141                    | ALLEN BRADLEY |
|             | Resistor, 75 k $\Omega$                       | 5                      | ALLEN BRADLEY |
|             | Resistor, 100 k $\Omega$                      | 1                      | ALLEN BRADLEY |
|             | Resistor, 330 k $\Omega$ , 1 w, 5%            | 3                      | ALLEN BRADLEY |
| Commercial  | Resistor, 430 $\Omega$ , 2 w, 5%              | 1                      | ALLEN BRADLEY |
|             | Resistor, 82 k $\Omega$ , 2 w, 5%             | 1                      | ALLEN BRADLEY |
|             | Resistor, 15 $\Omega$ , 2 w, 5%               | 1                      | ALLEN BRADLEY |



| Item Number | Description       | Quantity<br>per Instr. | Manufacturer |
|-------------|-------------------|------------------------|--------------|
| 97          | Transistor, NPN   | 6                      | CONTL. DVC.  |
| 18          | Transistor, NPN   | 12                     | TEXAS INSTR. |
| 302         | Transistor, NPN   | 23                     | TEXAS INSTR. |
| 305         | Transistor, PNP   | 218                    | TEXAS INSTR. |
| 309         | Transistor, PNP   | 6                      | TEXAS INSTR. |
| 69          | Transistor, PNP   | 1                      | TEXAS INSTR. |
| 51          | Transistor, PNP   | 2                      | TEXAS INSTR. |
|             | Transformer       | 1                      | NLS          |
| T2S         | Tube, Neon, 65 v  | 1                      | SIGNALITE    |
| 1           | Tube, Dual Triode | 2                      | SYLVANIA     |
| Y-900-A8    | Relay             | 2                      | BABCOCK      |
| 30          | Switch, Range     | 1                      | CHICAGO TEL. |
| 31          | Switch, Function  | 1                      | CHICAGO TEL. |
| 32          | Switch, Power     | 1                      | CHICAGO TEL. |

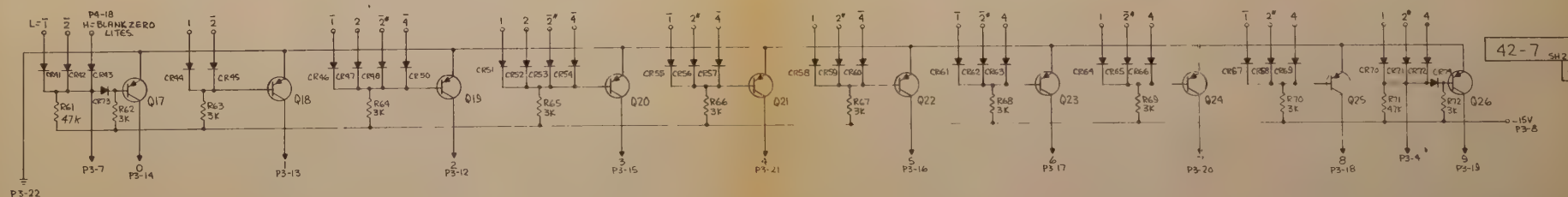
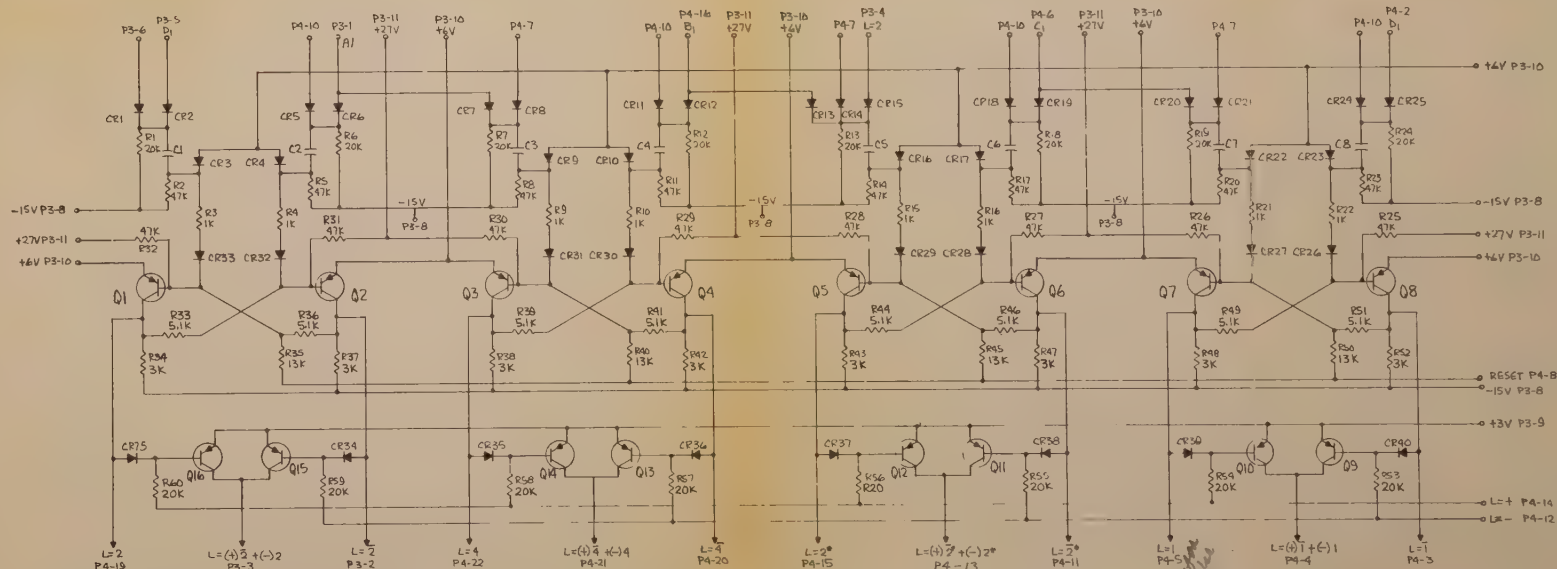


| Number | Description                         | Quantity<br>per Instru. | Manufacturer |
|--------|-------------------------------------|-------------------------|--------------|
| 016    | Resistors, 10.0 k $\Omega$ , 1%     | 1                       | NLS          |
|        | Resistors, 11.0 k $\Omega$ , 1%     | 1                       | NLS          |
|        | Resistors, 600 $\Omega$             | 1                       | NLS          |
|        | Resistors, 1 k $\Omega$             | 2                       | NLS          |
|        | Resistors, 40.0 k $\Omega$ , 1%     | 3                       | NLS          |
|        | Resistors, 2.0 k $\Omega$ , .1%     | 3                       | NLS          |
|        | Resistors, 2.8 k $\Omega$ , .1%     | 1                       | NLS          |
|        | Resistors, 6.8 k $\Omega$ , .1%     | 2                       | NLS          |
|        | Resistors, 15 k $\Omega$ , 1%       | 2                       | NLS          |
|        | Resistors, 99.111 k $\Omega$ , .05% | 1                       | NLS          |
|        | Resistors, 890 K $\Omega$ , .05%    | 1                       | NLS          |
|        | Resistors, 1.5 meg, .05%            | 6                       | NLS          |
|        | Resistors, 5.0 k $\Omega$ , .03%    | 1                       | NLS          |
|        | Resistors, 5.192 k $\Omega$ , .03%  | 1                       | NLS          |
|        | Resistors, 62.5 k $\Omega$ , .01%   | 4                       | NLS          |
|        | Resistors, 75 k $\Omega$ , .01%     | 3                       | NLS          |
|        | Resistors, 125 k $\Omega$ , .01%    | 9                       | NLS          |
|        | Resistors, 225 k $\Omega$ , .01%    | 3                       | NLS          |
|        | Resistors, 250 k $\Omega$ , .01%    | 5                       | NLS          |
| 29     | Diode, Zener, Matched Pair          | 1                       | CONT. DEV.   |
| 2-26   | Relay, Reed, Form A                 | 5                       | NLS          |





| REVISIONS |      |         |             |      |          |
|-----------|------|---------|-------------|------|----------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |
|           |      |         |             |      |          |



A2,3,4,5 Q'S = TRANSISTORS  
A2,3,4,5 C'S = CAPACITORS  
A2,3,4,5 R'S = RESISTORS  
A2,3,4,5 C'S = DIODES

A2,3,415 CRS= DIODES  
5. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

4. ALL TRANSISTORS 2N1305  
3 ALL DIODES NLS 5003-002  
2. ALL RESISTORS  $\frac{1}{2}$  W, 5%, CARBON  
1. ALL CAPACITORS: 0.001  $\mu$ f, 1000V

NOTES: UNLESS OTHERWISE SPECIFIED

↑

|                                                                                                                                         |                            |                                |                                                                                |                |                                                              |               |                |               |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------|--------------------------------------------------------------------------------|----------------|--------------------------------------------------------------|---------------|----------------|---------------|
| QTY<br>REQD                                                                                                                             | PART OR<br>IDENTIFYING NO. | NOMENCLATURE OR<br>DESCRIPTION | MFR<br>CODE                                                                    | CIRCUIT<br>REQ | ITEM<br>NO.                                                  | NEXT<br>ASSY. | FINAL<br>ASSY. | NEXT<br>ASSY. |
| PARTS LIST                                                                                                                              |                            |                                | APPLICATION                                                                    |                |                                                              |               |                |               |
| UNLESS OTHERWISE SPECIFIED<br>DIMENSIONS ARE IN INCHES<br>TOLERANCES ON<br>DECIMALS      ANGLES<br>± .01 30°<br>AND FRACTIONS<br>± 1/32 |                            |                                | DRAWN BY <i>DE JARDIN</i><br>CHECKED <i>DE JARDIN</i><br>APPR <i>DE JARDIN</i> |                | NON-LEAK SYSTEMS, INC.<br>DEL MAR, CALIFORNIA                |               |                |               |
| MATERIAL<br>SURFACE ROUGHNESS<br>PER MIL STD-10<br>DO NOT SCALE THIS DRAWING                                                            |                            |                                | FINISH                                                                         |                | - SCHEMATIC DIAGRAM -<br>*DECADE BOARD<br>MODEL: SERIES 4200 |               |                |               |
| DATE                                                                                                                                    |                            |                                | CODE IDENT NO.                                                                 |                | SIZE                                                         | 42-7          |                |               |
| SCALE                                                                                                                                   |                            |                                | WEIGHT                                                                         |                | SHEET 2                                                      |               |                |               |

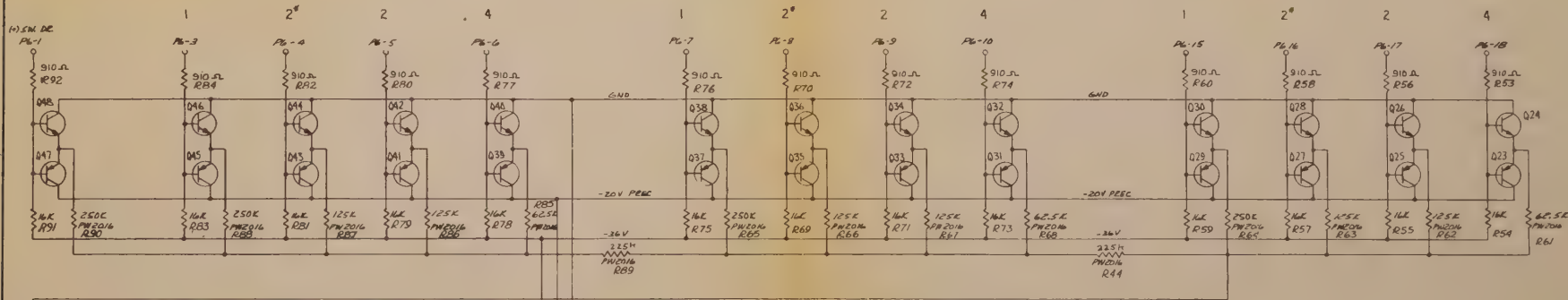
|   |       |
|---|-------|
|   | 0     |
| 1 | 1     |
| 2 | 01    |
| 3 | 11    |
| 4 | 001   |
| 5 | 110   |
| 6 | 0011  |
| 7 | 1001  |
| 8 | 00101 |
| 9 | 11001 |

| REVISIONS |      |         |             |      |          |
|-----------|------|---------|-------------|------|----------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |
|           |      |         |             |      |          |

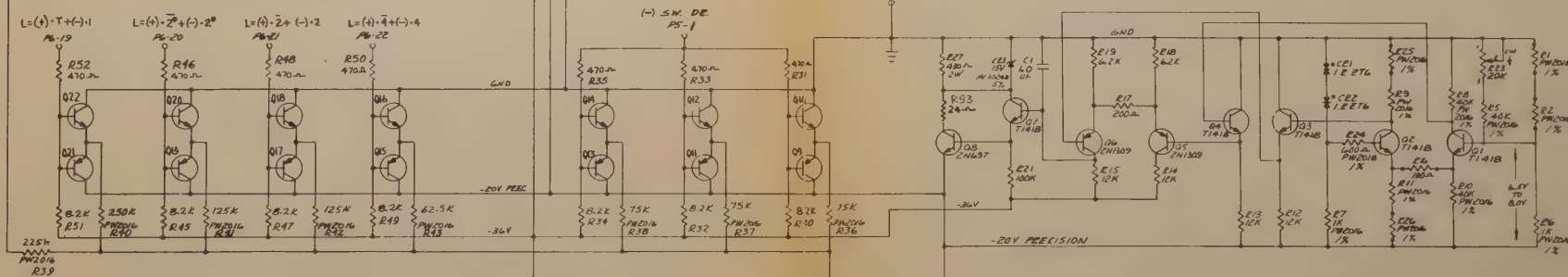
# UNITS DECADA

# TENS DECADA

# HUNDREDS DECADA



# THOUSANDS DECADA



A6 Q'S = TRANSISTORS  
A6 C'S = CAPACITORS  
A6 R'S = RESISTORS  
A6 D'S = DIODES

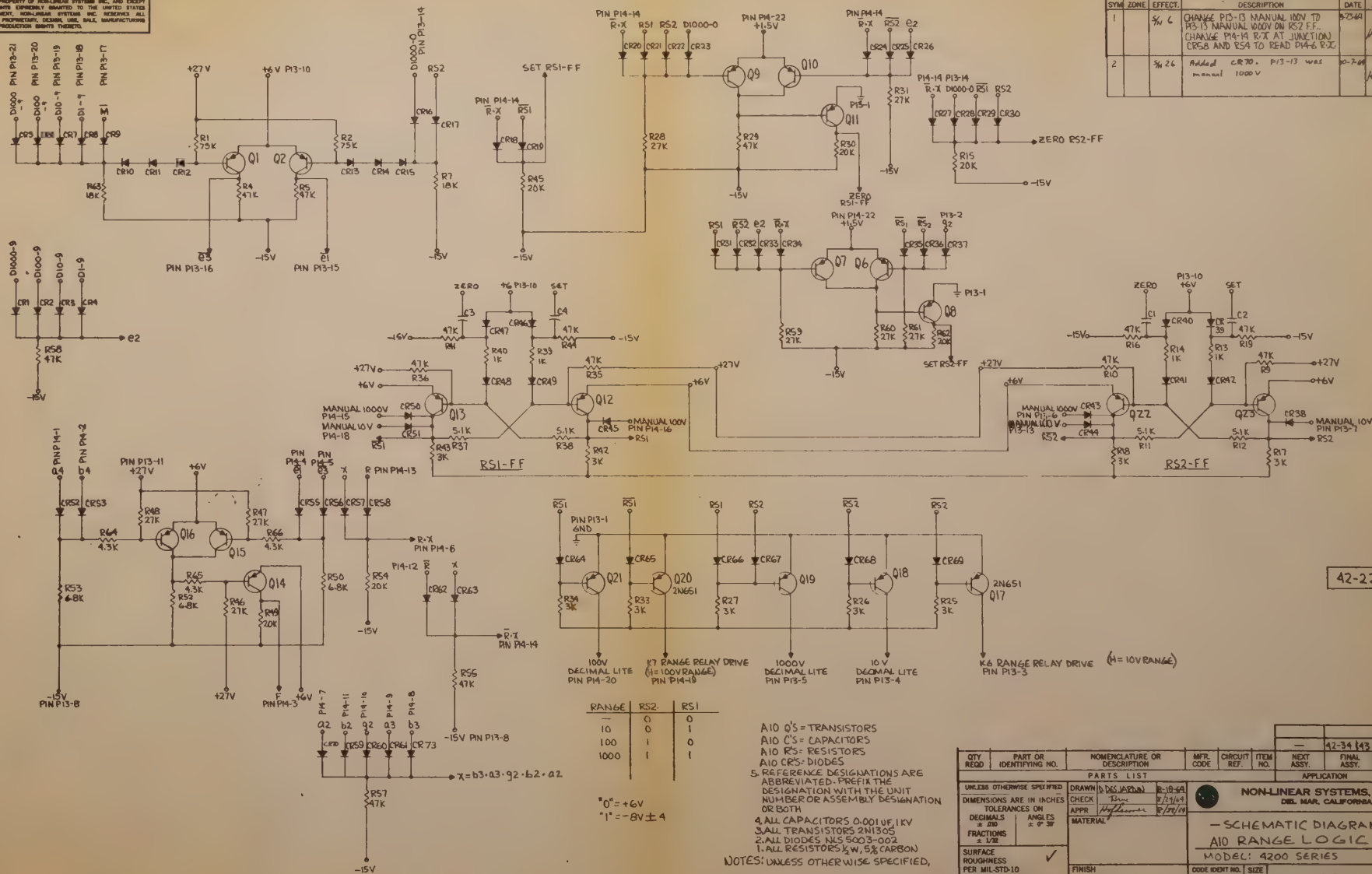
B. REFERENCE DESIGNATIONS ARE ABBREVIATED PER THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

1. ER14 OR R2 DIODES AND Q14 Q2 TO BE FACTORY SELECTED
  2. ALL NPN TRANSISTORS 2N130C
  3. ALL PNP TRANSISTORS 2N130A
  4. ALL 2N130C TRANSISTORS TO BE .01% OR BETTER
  5. CE1, CE2, CE3 ARE MATCHED FOR LOW TEMP. COEFF.
  6. R1, R2, R3, R4, R5, R6 TO BE FACTORY SELECTED
  7. ALL RESISTORS 1/4W, 5% COMP.
- NOTES: UNLESS OTHERWISE SPECIFIED

|                                                                                                  |                            |                                |  |  |  |                 |                 |             |               |         |                |           |                         |                                      |  |      |  |                                                                      |  |  |  |
|--------------------------------------------------------------------------------------------------|----------------------------|--------------------------------|--|--|--|-----------------|-----------------|-------------|---------------|---------|----------------|-----------|-------------------------|--------------------------------------|--|------|--|----------------------------------------------------------------------|--|--|--|
|                                                                                                  |                            |                                |  |  |  |                 |                 |             |               |         |                | 42-23 547 |                         |                                      |  |      |  |                                                                      |  |  |  |
|                                                                                                  |                            |                                |  |  |  |                 |                 |             |               |         |                | 42-23 34  |                         | 1                                    |  |      |  |                                                                      |  |  |  |
| QTY<br>REQD                                                                                      | PART OR<br>IDENTIFYING NO. | NOMENCLATURE OR<br>DESCRIPTION |  |  |  | MFR.<br>CODE    | CIRCUIT<br>REF. | ITEM<br>NO. | NEXT<br>ASSY. |         | FINAL<br>ASSY. |           | NEXT FINAL<br>ASSY ASSY |                                      |  |      |  |                                                                      |  |  |  |
| PARTS LIST                                                                                       |                            |                                |  |  |  |                 |                 |             |               |         |                |           |                         | APPLICATION                          |  | QTY. |  |                                                                      |  |  |  |
| UNLESS OTHERWISE SPECIFIED<br>DIMENSIONS ARE IN INCHES<br>TOLERANCES ON<br>DECIMALS<br>FRACTIONS |                            |                                |  |  |  |                 |                 |             |               |         |                |           |                         | DRAWN<br>CHECKED<br>APPR<br>MATERIAL |  |      |  | NLS<br>NON-LINEAR SYSTEMS, INC.<br>DEI. MAR., CALIFORNIA             |  |  |  |
| SURFACE<br>ROUGHNESS<br>PER MIL-STD-10<br>DO NOT SCALE THIS DRAWING<br>RELEASE<br>DATE           |                            |                                |  |  |  |                 |                 |             |               |         |                |           |                         | ✓                                    |  |      |  | SCHEMATIC DIAGRAM -<br>A6 DIGITAL-TO ANALOG CONVERTER<br>SERIES 4200 |  |  |  |
| FINISH                                                                                           |                            |                                |  |  |  | CODE IDENT. NO. |                 | SIZE        |               | 42-10   |                |           |                         |                                      |  |      |  |                                                                      |  |  |  |
|                                                                                                  |                            |                                |  |  |  | 03626           |                 | D           |               |         |                |           |                         |                                      |  |      |  |                                                                      |  |  |  |
|                                                                                                  |                            |                                |  |  |  | SCALE           |                 | WEIGHT      |               | SHEET 2 |                |           |                         |                                      |  |      |  |                                                                      |  |  |  |



| REVISIONS |      |        |                                                            | DATE    | APPROVED         |
|-----------|------|--------|------------------------------------------------------------|---------|------------------|
| SYM       | ZONE | EFFECT | DESCRIPTION                                                |         |                  |
| 1         |      | 1/6    | CHANGE P13-13 MANUAL 100V TO P13-13 MANUAL 100V ON RS2 FF. | 9-7-61  | <i>H. J. ...</i> |
| 2         |      | 2/6    | Added CR70. P13-13 was manual 1000 V                       | 10-7-61 | <i>H. J. ...</i> |



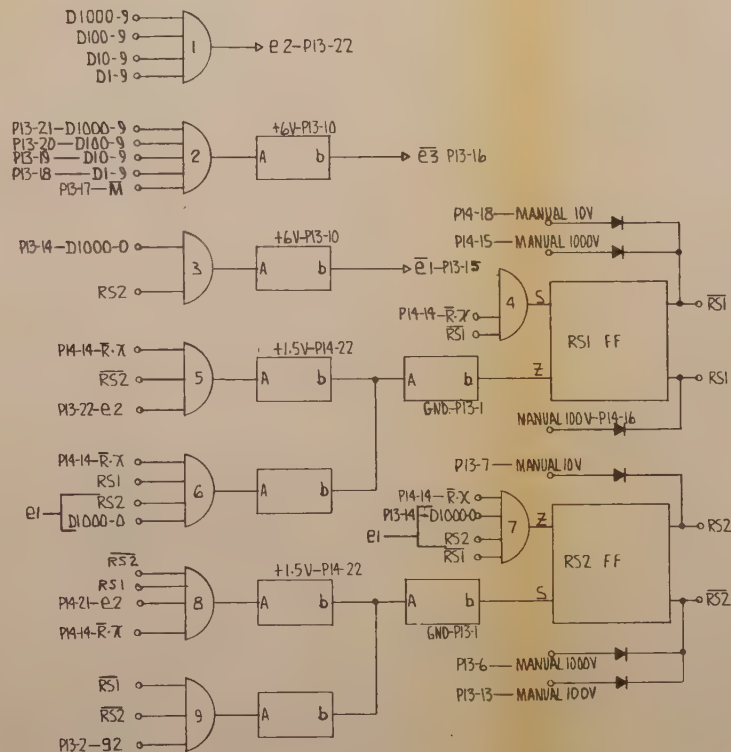
42-22 SH2  
1

| QTY REQD                                                                                                                                                                                | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR CODE | CIRCUIT REF. | ITEM NO. | 42-34143                                 | 1     | 1 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------|----------|--------------|----------|------------------------------------------|-------|---|
| PARTS LIST                                                                                                                                                                              |                         |                             |          |              |          | APPLICATION                              | QTY.  |   |
| UNLESS OTHERWISE SPECIFIED<br>DIMENSIONS ARE IN INCHES<br>TOLERANCES ON<br>DECIMALS<br>FRACTIONS<br>SURFACE<br>ROUGHNESS<br>PER MIL-STD-10<br>DO NOT SCALE THIS DRAWING<br>RELEASE DATE |                         |                             |          |              |          | 10-8-61                                  |       |   |
| DRAWN<br>CHECK<br>APPR<br>MATERIAL                                                                                                                                                      |                         |                             |          |              |          | 10-8-61<br>10-8-61<br>10-8-61<br>10-8-61 |       |   |
| FINISH                                                                                                                                                                                  |                         |                             |          |              |          |                                          |       |   |
| CODE IDENT NO. SIZE                                                                                                                                                                     |                         |                             |          |              |          | 03626 D                                  | 42-22 |   |
| SCALE                                                                                                                                                                                   |                         |                             |          |              |          |                                          |       |   |
| WEIGHT                                                                                                                                                                                  |                         |                             |          |              |          |                                          |       |   |
| SHEET 2                                                                                                                                                                                 |                         |                             |          |              |          |                                          |       |   |

NON-LINEAR SYSTEMS, INC.  
DRL MAR, CALIFORNIA  
- SCHEMATIC DIAGRAM -  
A10 RANGE LOGIC  
MODEL: 4200 SERIES

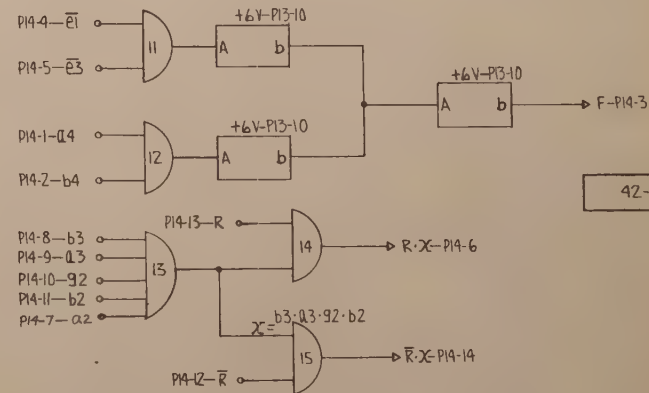
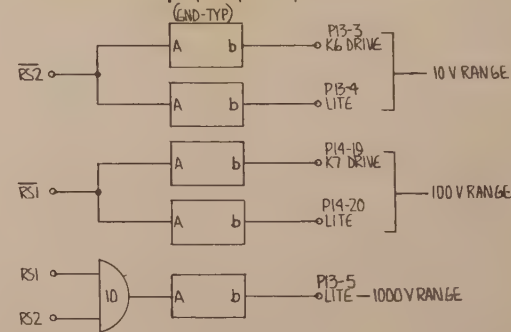


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1, P5=PIN NUMBERS.  
NOTES: UNLESS OTHERWISE SPECIFIED.

| REVISIONS |      |        |                                                |         |             |
|-----------|------|--------|------------------------------------------------|---------|-------------|
| SYM       | ZONE | EFFECT | DESCRIPTION                                    | DATE    | APPROVED    |
| 1         |      | SYM 26 | Added a2 to gate 13<br>P13-13 was Manual 1000V | 10-7-64 | H. J. J. J. |



42-22 SH3  
1

|                                  |                         |                             |           |              |          |                           |           |   |   |
|----------------------------------|-------------------------|-----------------------------|-----------|--------------|----------|---------------------------|-----------|---|---|
| QTY REQD                         | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO. | FINAL ASSY.               | 42-34 143 | 1 | 1 |
| PARTS LIST                       |                         |                             |           |              |          | APPLICATION QTY.          |           |   |   |
| UNLESS OTHERWISE SPECIFIED       |                         |                             |           |              |          | FINAL                     |           |   |   |
| CHECK                            |                         |                             |           |              |          | 1-15-64                   |           |   |   |
| DIMENSIONS ARE IN INCHES         |                         |                             |           |              |          | 9-23-64                   |           |   |   |
| TOLERANCES ON                    |                         |                             |           |              |          | H. J. J. J.               |           |   |   |
| DECIMALS ± .010                  |                         |                             |           |              |          | 9/23/64                   |           |   |   |
| ANGLES ± 0° 30'                  |                         |                             |           |              |          |                           |           |   |   |
| FRACTIONS ± 1/32                 |                         |                             |           |              |          |                           |           |   |   |
| SURFACE ROUGHNESS PER MIL-STD-10 |                         |                             |           |              |          | NON-LINEAR SYSTEMS, INC.  |           |   |   |
| DO NOT SCALE THIS DRAWING        |                         |                             |           |              |          | DEL MAR, CALIFORNIA       |           |   |   |
| RELEASE DATE 10-8-64             |                         |                             |           |              |          | RANGE LOGIC BLOCK DIAGRAM |           |   |   |
|                                  |                         |                             |           |              |          | SERIES 4200               |           |   |   |
|                                  |                         |                             |           |              |          | CODE IDENT NO. 03626      |           |   |   |
|                                  |                         |                             |           |              |          | SIZE C                    |           |   |   |
|                                  |                         |                             |           |              |          | 42-22                     |           |   |   |
|                                  |                         |                             |           |              |          | SCALE WEIGHT SHEET 3      |           |   |   |



| REVISIONS |      |         |             |      |          |
|-----------|------|---------|-------------|------|----------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |
|           |      |         |             |      |          |

YOU CAN TRIGGER THE INSTRUMENT TO START A MEASUREMENT IN ANY OF FOUR WAYS.

1. IF YOU WANT THE INSTRUMENT TO START AUTOMATICALLY, SET THE TRIGGER SWITCH (LOCATED ON THE FRONT PANEL) AT "CONTINUOUS SCAN". THE INSTRUMENT WILL THEN CONTINUE TO MAKE MEASUREMENTS.
2. TO MAKE A SINGLE MEASUREMENT UNDER MANUAL CONTROL, ROTATE THE TRIGGER SWITCH FROM "STAND-BY" TO "SINGLE SCAN". TO MAKE ANOTHER SINGLE MEASUREMENT, ROTATE THE TRIGGER SWITCH TO "STAND-BY" AND THEN TO "SINGLE SCAN".

3. TO START A MEASUREMENT UNDER CONTROL OF A REMOTELY LOCATED "FORM C" BREAK-BEFORE-MAKE CONTACT CLOSURE, MAKE CONNECTIONS AS SHOWN IN FIGURE 1. SET THE TRIGGER SWITCH TO "EXTERNAL TRIGGER". A MEASUREMENT CAN THEN BE STARTED BY MOVING THE ARMATURE OF THE EXTERNAL CONTACT DEVICE FROM THE NORMALLY CLOSED CONTACT TO THE NORMALLY OPEN CONTACT.

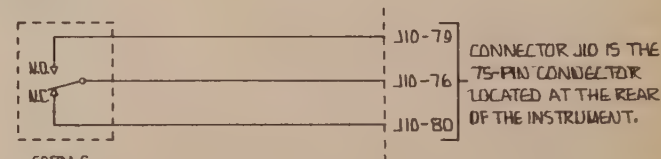
BEFORE ANOTHER MEASUREMENT CAN BE STARTED, CONTACT MUST BE MADE BETWEEN THE ARMATURE AND THE NORMALLY CLOSED CONTACT.

CAPACITANCE TO EARTH OF THE EXTERNAL CONTACT DEVICE AND ITS ASSOCIATED LEADS CAN REDUCE THE COMMON-MODE REJECTION CAPABILITY OF THE INSTRUMENT.

4. TO START A MEASUREMENT BY AN EXTERNAL PULSE:

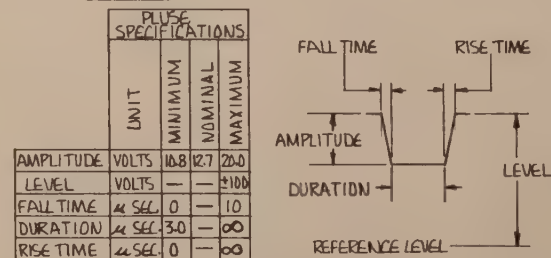
- a. SET THE TRIGGER SWITCH TO "EXTERNAL TRIGGER".
- b. CONNECT A JUMPER FROM J10-76 TO J10-80 AT THE REAR OF THE INSTRUMENT.
- c. APPLY A NEGATIVE PULSE HAVING THE CHARACTERISTICS SHOWN IN FIGURE 2 TO J10-82. EACH PULSE STARTS ONE MEASUREMENT.

FIGURE 1



FORM C  
BREAK-BEFORE-MAKE  
EXTERNAL CONTACT

FIGURE 2



REFERENCE LEVEL: SIGNAL GND

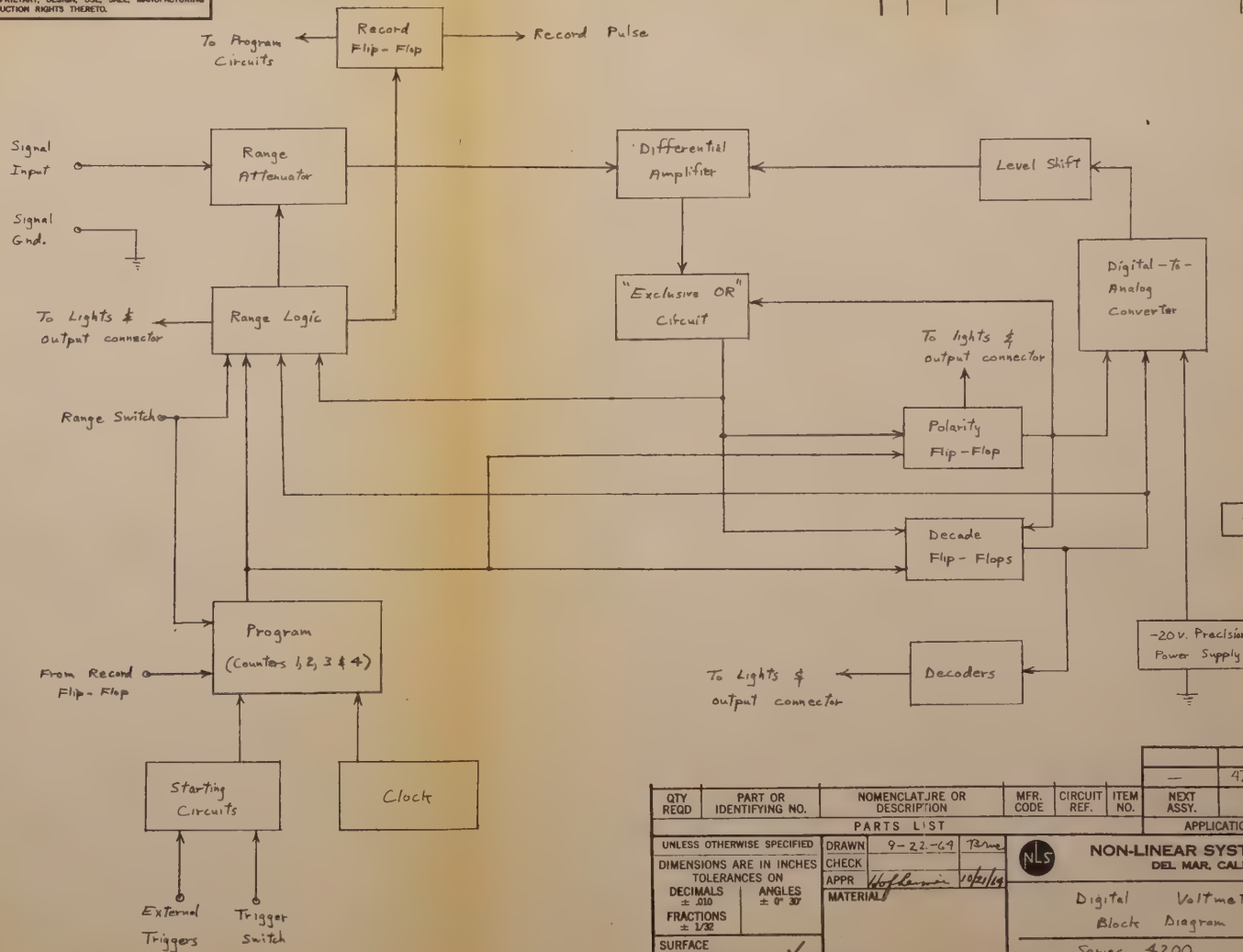
42-53 SH.1  
0

|                            |                         |                                    |           |                                 |          |                          |             |                  |
|----------------------------|-------------------------|------------------------------------|-----------|---------------------------------|----------|--------------------------|-------------|------------------|
| QTY REQD                   | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION        | MFR. CODE | CIRCUIT REF.                    | ITEM NO. | NEXT ASSY.               | FINAL ASSY. | NEXT FINAL ASSY. |
|                            |                         |                                    |           |                                 |          |                          |             |                  |
| PARTS LIST                 |                         |                                    |           |                                 |          | APPLICATION QTY.         |             |                  |
| UNLESS OTHERWISE SPECIFIED |                         | DRAWN DES JARDIN 9-29-64           |           | CHECK <i>Brue</i> 9-29-64       |          | NON-LINEAR SYSTEMS, INC. |             |                  |
| DIMENSIONS ARE IN INCHES   |                         | TOLERANCES ON                      |           | APPR <i>H. H. H. H.</i> 9/29/64 |          | DIE, CALIFORNIA          |             |                  |
| DECIMALS ± .010            |                         | ANGLES ± 0° 30'                    |           | MATERIAL                        |          | TRIGGERING METHODS       |             |                  |
| FRACTIONS ± 1/32           |                         | SURFACE ROUGHNESS PER MIL-STD-10 ✓ |           | FINISH                          |          | SERIES 4200              |             |                  |
| DO NOT SCALE THIS DRAWING  |                         | CODE IDENT NO. 03626               |           | SIZE C                          |          | 42-53                    |             |                  |
| RELEASE DATE               |                         | SCALE                              |           | WEIGHT                          |          | SHEET 1                  |             |                  |



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| REVISIONS |      |         |             |      |          |
|-----------|------|---------|-------------|------|----------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |
|           |      |         |             |      |          |



42-62, SH 5

-20V. Precision Power Supply

|                                    |                         |                             |           |              |          |                                                 |         |
|------------------------------------|-------------------------|-----------------------------|-----------|--------------|----------|-------------------------------------------------|---------|
| QTY REQD                           | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO. | 42-62                                           | 1       |
| PARTS LIST                         |                         |                             |           |              |          | 42-62                                           | 1       |
| UNLESS OTHERWISE SPECIFIED         |                         |                             |           |              |          | APPLICATION                                     |         |
| DIMENSIONS ARE IN INCHES           |                         |                             |           |              |          | QTY.                                            |         |
| TOLERANCES ON                      |                         |                             |           |              |          |                                                 |         |
| DECIMALS ± .010                    |                         |                             |           |              |          |                                                 |         |
| ANGLES ± 0° 30'                    |                         |                             |           |              |          |                                                 |         |
| FRACTIONS ± 1/32                   |                         |                             |           |              |          |                                                 |         |
| SURFACE ROUGHNESS PER MIL-STD-10 ✓ |                         |                             |           |              |          | NON-LINEAR SYSTEMS, INC.<br>DEL MAR, CALIFORNIA |         |
| DO NOT SCALE THIS DRAWING          |                         |                             |           |              |          | Digital Voltmeter<br>Block Diagram              |         |
| RELEASE DATE 11-9-64               |                         |                             |           |              |          | Series 4200                                     |         |
| FINISH                             |                         |                             |           |              |          | CODE IDENT NO. 03626                            | SIZE C  |
|                                    |                         |                             |           |              |          | 42-62                                           |         |
| SCALE                              |                         |                             |           |              |          | WEIGHT                                          | SHEET 5 |



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| REVISIONS |      |         |             |      |          |
|-----------|------|---------|-------------|------|----------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |
|           |      |         |             |      |          |

A8 Q'S = TRANSISTORS  
A8 C'S = CAPACITORS  
A8 R'S = RESISTORS  
A8 RS = DIODES  
5. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

3. ALL RESISTORS  $\frac{1}{2}$  W, 5%, 0.1%  
3. ALL TRANSISTORS 2A-1305  
2. ALL DIODES NLS 5075-002  
1. ALL CAPACITORS 0.001uf, 100V

NOTES: UNLESS OTHERWISE SPECIFIED

| QTY REQ                          | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR CODE      | CIRCUIT         | ITEM NO                                    | NEXT ASSY      | PREV ASSY | NEXT ASSY |
|----------------------------------|-------------------------|-----------------------------|---------------|-----------------|--------------------------------------------|----------------|-----------|-----------|
| PARTS LIST                       |                         |                             |               |                 |                                            | APP. CAT. N. 2 |           |           |
| UNLESS OTHERWISE SPECIFIED       |                         | DRAWN <i>J. D. L.</i>       | <i>1/11/5</i> | NLS             | NON-LINEAR SYSTEMS, INC.                   |                |           |           |
| DIMENSIONS ARE IN INCHES         |                         | CHECKED <i>John</i>         | <i>1/16/5</i> |                 | DEL. MAR. CALIFORNIA                       |                |           |           |
| TOLERANCES ON DECIMALS           |                         | APPR. <i>W. H. H.</i>       | <i>1/26/5</i> |                 | SCHEMATIC DIAGRAM -<br>AS-COUNTES 3 AND 4. |                |           |           |
| ANGLES $\pm .02$                 |                         | MATERIAL                    |               |                 |                                            |                |           |           |
| FRACTIONS $\pm .01$              |                         |                             |               | SERIES 4200     |                                            |                |           |           |
| SURFACE ROUGHNESS PER MIL-STD-10 |                         | ✓                           | FINISH        | CODE IDENT. NO. | SIZE                                       | 42-65          |           |           |
| DO NOT SCALE THIS DRAWING        |                         |                             |               | 03626           | SCALE                                      | WEIGHT         | SHEET 2   |           |
| RELEASE DATE                     |                         | 2-1-5                       |               |                 |                                            |                |           |           |



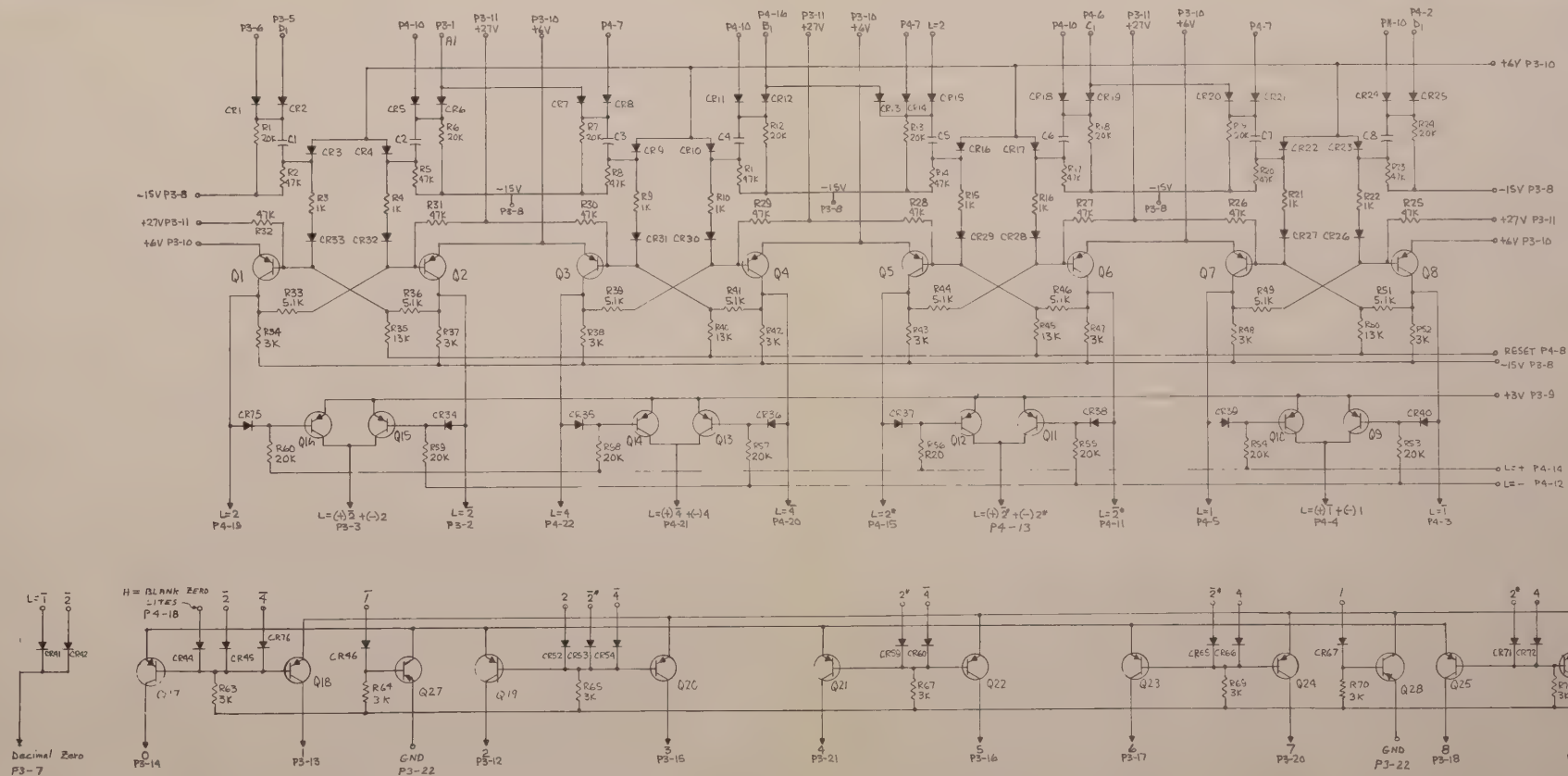


|                                               |                         |                             |                                                 |                           |          |             |             |       |
|-----------------------------------------------|-------------------------|-----------------------------|-------------------------------------------------|---------------------------|----------|-------------|-------------|-------|
| QTY REQD                                      | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE                                       | CIRCUIT REF.              | ITEM NO. | NEXT ASSY.  | FINAL ASSY. | FINAL |
| PARTS LIST                                    |                         |                             |                                                 |                           |          | APPLICATION |             | QTY.  |
| UNLESS OTHERWISE SPECIFIED                    |                         |                             | DRAWN                                           | <i>H. Duchois</i> 1/24/65 |          |             |             |       |
| DIMENSIONS ARE IN INCHES                      |                         |                             | CHECKED                                         | <i>B. Bane</i> 1-28-65    |          |             |             |       |
| TOLERANCES ON DECIMALS ± .010 ANGLES ± 9° 30' |                         |                             | APPROVED                                        | <i>H. Duchois</i> 1-28-65 |          |             |             |       |
| FRACTIONS ± 1/32                              |                         |                             | MATERIAL                                        |                           |          |             |             |       |
| SURFACE ROUGHNESS PER MIL-STD-10 ✓            |                         |                             | NON-LINEAR SYSTEMS, INC.<br>DEL MAR, CALIFORNIA |                           |          |             |             |       |
| DO NOT SCALE THIS DRAWING                     |                         |                             | COUNTERS 3 AND 4 - BLACK DIAGRAM                |                           |          |             |             |       |
| RELEASE DATE 2/18/65                          |                         |                             | SERIES 4200                                     |                           |          |             |             |       |
|                                               |                         |                             | CODE IDENT NO. 03626                            |                           | SIZE C   | 42-65       |             |       |
|                                               |                         |                             | SCALE                                           |                           | WEIGHT   | SHEET 3     |             |       |





| REVISIONS |      |                    |                  |        |                    |
|-----------|------|--------------------|------------------|--------|--------------------|
| SYM       | ZONE | EFFECT.            | DESCRIPTION      | DATE   | APPROVED           |
| A         |      | S <sub>N</sub> 150 | Added data CR 76 | 3-9-65 | <i>[Signature]</i> |



A2,3,4,5 Q's = TRANSISTORS  
A2,3,4,5 C's = CAPACITORS  
A2,3,4,5 R's = RESISTORS  
A2,3,4,5 CR's = DIODES

5. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

4. ALL TRANSISTORS 2N1305
3. ALL DIODES NLS 5003-002
2. ALL RESISTORS  $\frac{1}{2}$  W, 5%, CARBON

1. ALL CAPACITORS 0.001  $\mu$ f, 1000V  
NOTES: UNLESS OTHERWISE SPECIFIED

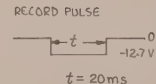


\*  $A_2, A_3, A_4, \& A_5$

|                                     |                         |                             |                       |              |         |                                                                                                                                                                                                                                                     |       |                 |                  |
|-------------------------------------|-------------------------|-----------------------------|-----------------------|--------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------|------------------|
| QTY REQ                             | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE             | CIRCUIT REF. | ITEM NO | Final<br>NEXT ASSY.                                                                                                                                                                                                                                 | 42-62 | 4<br>NEXT ASSY. | 4<br>FINAL ASSY. |
| PARTS LIST                          |                         |                             |                       |              |         | APPLICATION QTY.                                                                                                                                                                                                                                    |       |                 |                  |
| UNLESS OTHERWISE SPECIFIED          |                         |                             | DRAWN <i>Brice</i>    |              | 1-27-65 | <div>NLS</div> <div>NON-LEADER SYSTEMS, INC.<br/>DEL MAR, CALIFORNIA</div> <div>-SCHEMATIC DIAGRAM-<br/>*DECADE BOARD</div> <div>MODEL: SERIES 4200</div> <div>CODE IDENT. NO. <b>03626</b> SIZE <b>D</b></div> <div>42-75</div> <div>SHEET 2</div> |       |                 |                  |
| DIMENSIONS ARE IN INCHES            |                         |                             | CHECK                 |              |         |                                                                                                                                                                                                                                                     |       |                 |                  |
| TOLERANCES ON DECIMALS              |                         |                             | APPR <i>H. Palmer</i> |              | 1-27-65 |                                                                                                                                                                                                                                                     |       |                 |                  |
| ANGLES<br>= 1/32                    |                         |                             | MATERIAL              |              |         |                                                                                                                                                                                                                                                     |       |                 |                  |
| SURFACE ROUGHNESS<br>PER MIL-STD-10 |                         |                             | FINISH                |              |         |                                                                                                                                                                                                                                                     |       |                 |                  |
| RELEASE DATE 3-17-65                |                         |                             |                       |              |         |                                                                                                                                                                                                                                                     |       |                 |                  |



| REVISIONS |      |         |             |      |          |
|-----------|------|---------|-------------|------|----------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |
|           |      |         |             |      |          |



- 6. POWER SUPPLY VOLTAGES SHOWN ARE IN VOLTS DC AVERAGE VALUE WITH 15%V LINE AND THE APPROXIMATE CURRENTS SHOWN. TYPICAL LINE FREQUENCY RIPPLE IS SHOWN IN BRACKETS IN VOLTS PEAK-TO-PEAK. OTHER DC VOLTAGES ARE IN VOLTS-RMS.
- 5.
  - AI Q'S = TRANSISTORS
  - AI C'S = CAPACITORS
  - AI R'S = RESISTORS
  - AI CR'S = DIODES
- 4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
- 3. ALL TRANSISTORS ARE 2N1305
- 2. ALL DIODES ARE NUS 5003-002
- 1. ALL RESISTORS ARE  $\frac{1}{2}W, 5\%$  CARBON NOTES UNLESS OTHERWISE SPECIFIED

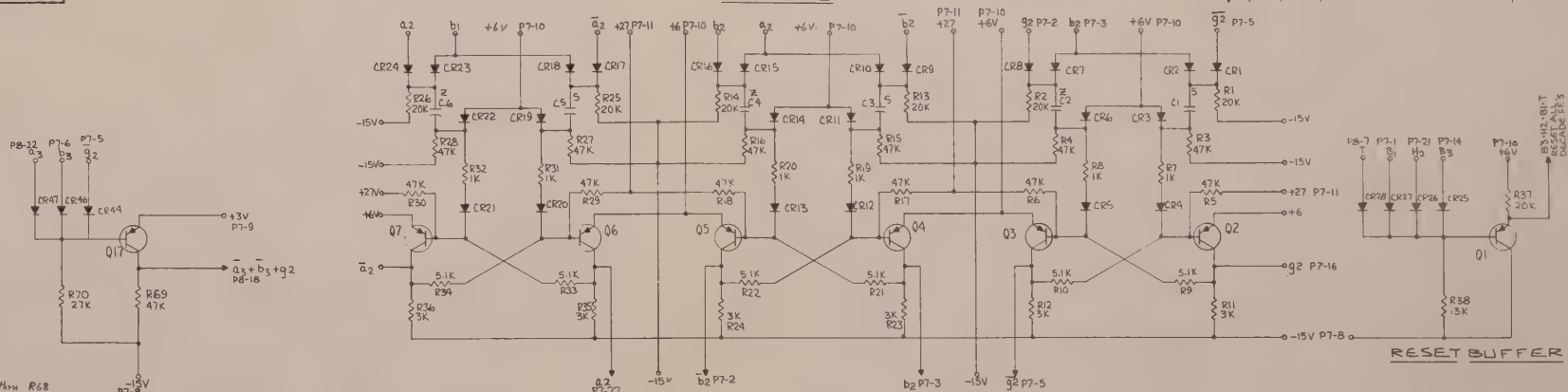
42-83<sub>SM</sub>

|                                                                                                                         |  |  |  |                                                                                                                                    |  |                                                                                                                                              |  |
|-------------------------------------------------------------------------------------------------------------------------|--|--|--|------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                                                                                                         |  |  |  |                                                                                                                                    |  | <div style="display: flex; justify-content: space-between;"> <span>—</span> <span>4247.50</span> <span>—</span> </div>                       |  |
|                                                                                                                         |  |  |  |                                                                                                                                    |  | <div style="display: flex; justify-content: space-between;"> <span>NEXT ASSY.</span> <span>FINAL ASSY.</span> <span>NEXT ASSY.</span> </div> |  |
|                                                                                                                         |  |  |  |                                                                                                                                    |  | <div style="display: flex; justify-content: space-between;"> <span>APPLICATION</span> <span>QTY.</span> </div>                               |  |
| QTY. REQ.      PART OR IDENTIFYING NO.      NOMENCLATURE OR DESCRIPTION      MFR. CODE      CIRCUIT. REF.      ITEM NO. |  |  |  |                                                                                                                                    |  |                                                                                                                                              |  |
| PARTS LIST<br>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .10 ANGLES ± .5°               |  |  |  | DRAWING CHECK APPR. <i>W. J. [Signature]</i> 1/24/65 1/24/65 1/24/65<br>MATERIAL <i>1/24/65</i>                                    |  |                                                                                                                                              |  |
| SURFACE ROUGHNESS PER MIL-STD-10 <input checked="" type="checkbox"/>                                                    |  |  |  | FINISH                                                                                                                             |  |                                                                                                                                              |  |
| DO NOT SCALE THIS DRAWING                                                                                               |  |  |  | CODE IDENT. NO. <b>03626</b> SIZE <b>D</b>                                                                                         |  |                                                                                                                                              |  |
| RELEASE DATE <i>2/18/65</i>                                                                                             |  |  |  | SCALE _____ WEIGHT _____ SHEET <i>2</i>                                                                                            |  |                                                                                                                                              |  |
|                                                                                                                         |  |  |  | NON-LINEAR SYSTEMS, INC.<br>DEL. MAR. CALIFORNIA<br>— SCHEMATIC DIAGRAM —<br>AI POWER SUPPLY<br>MODEL: 4200 SERIES<br><b>42-83</b> |  |                                                                                                                                              |  |



# COUNTER 2

| REVISIONS |      |        |             |               |
|-----------|------|--------|-------------|---------------|
| SYM       | ZONE | EFFECT | DESCRIPTION | DATE APPROVED |
|           |      |        |             |               |

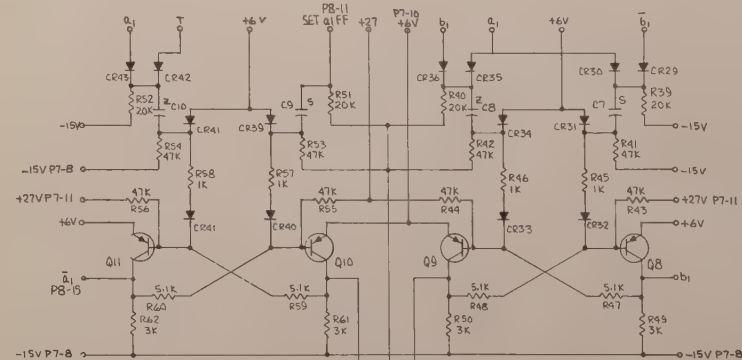
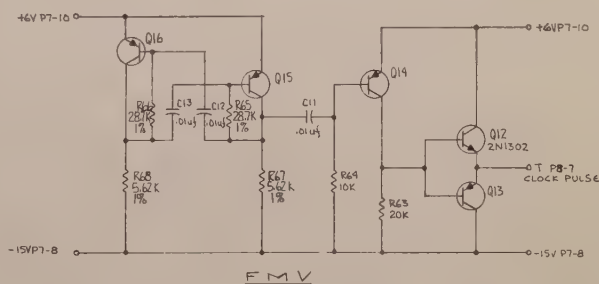


7. Resistors R65 thru R68 may be 1/4 or 1/2 watt.

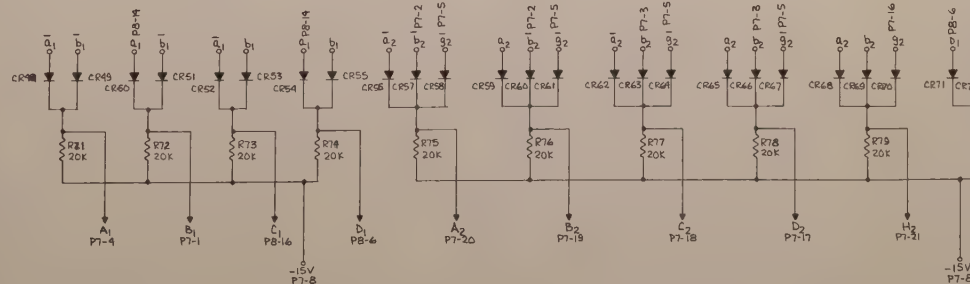
- 6. AT Q3 = TRANSISTORS
- AT C5 = CAPACITORS
- AT R5 = RESISTORS
- AT CR5 = DIODES
- 5. REFERENCE DESIGNATIONS ARE ABBREVIATED: PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

- 4. ALL TRANSISTORS 2N1305
- 3. ALL DIODES NLS 5003-002
- 2. ALL CAPACITORS 0.001 uF, 1000 V
- 1. ALL RESISTORS 1/2 W, 5% CARBON

NOTES: UNLESS OTHERWISE SPECIFIED.



## COUNTER 1



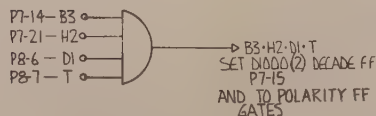
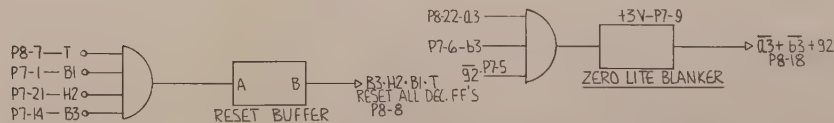
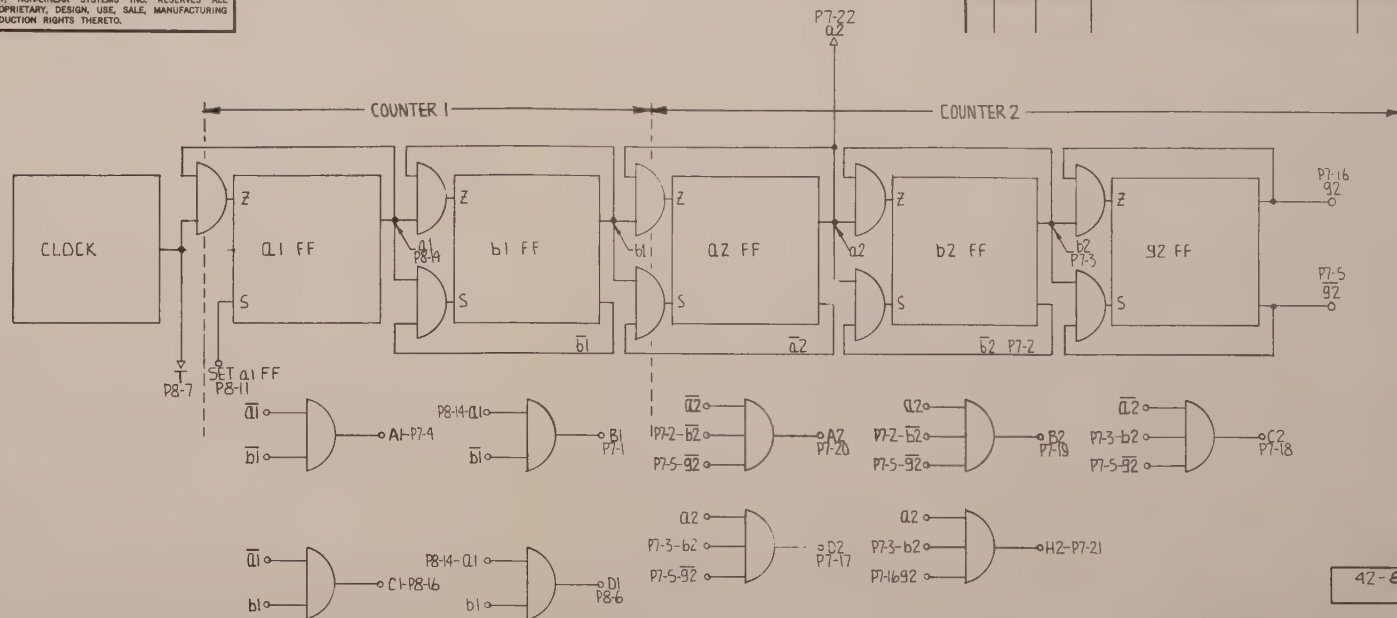
|          |                         |                             |          |              |          |            |             |                  |
|----------|-------------------------|-----------------------------|----------|--------------|----------|------------|-------------|------------------|
| QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR CODE | CIRCUIT REF. | ITEM NO. | NEXT ASSY. | FINAL ASSY. | NEXT FINAL ASSY. |
|          |                         |                             |          |              |          |            |             |                  |

|                                  |                         |                          |  |
|----------------------------------|-------------------------|--------------------------|--|
| PARTS LIST                       |                         | APPLICATION              |  |
| UNLESS OTHERWISE SPECIFIED       | DRAWN: <i>Shyatt</i>    | NON-LINEAR SYSTEMS, INC. |  |
| DIMENSIONS ARE IN INCHES         | CHECK: <i>Shyatt</i>    | DEL MAR, CALIFORNIA      |  |
| TOLERANCES ON DECIMALS = .010    | APPR: <i>Shyatt</i>     | - SCHEMATIC DIA GRAM -   |  |
| FRACTIONS = 1/32                 | MATERIAL: <i>Shyatt</i> | A7-COUNTERS 1 & 2        |  |
| SURFACE ROUGHNESS PER MIL-STD-10 | FINISH                  | MODEL: SERIES 4200       |  |
| DO NOT SCALE THIS DRAWING        |                         | CODE IDENT NO. SIZE      |  |
| RELEASE DATE: 2/18/65            |                         | 03626 D 42-86            |  |
|                                  |                         | SCALE WEIGHT SHEET 2     |  |



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| REVISIONS |      |         |             |      |          |  |
|-----------|------|---------|-------------|------|----------|--|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |  |
|           |      |         |             |      |          |  |

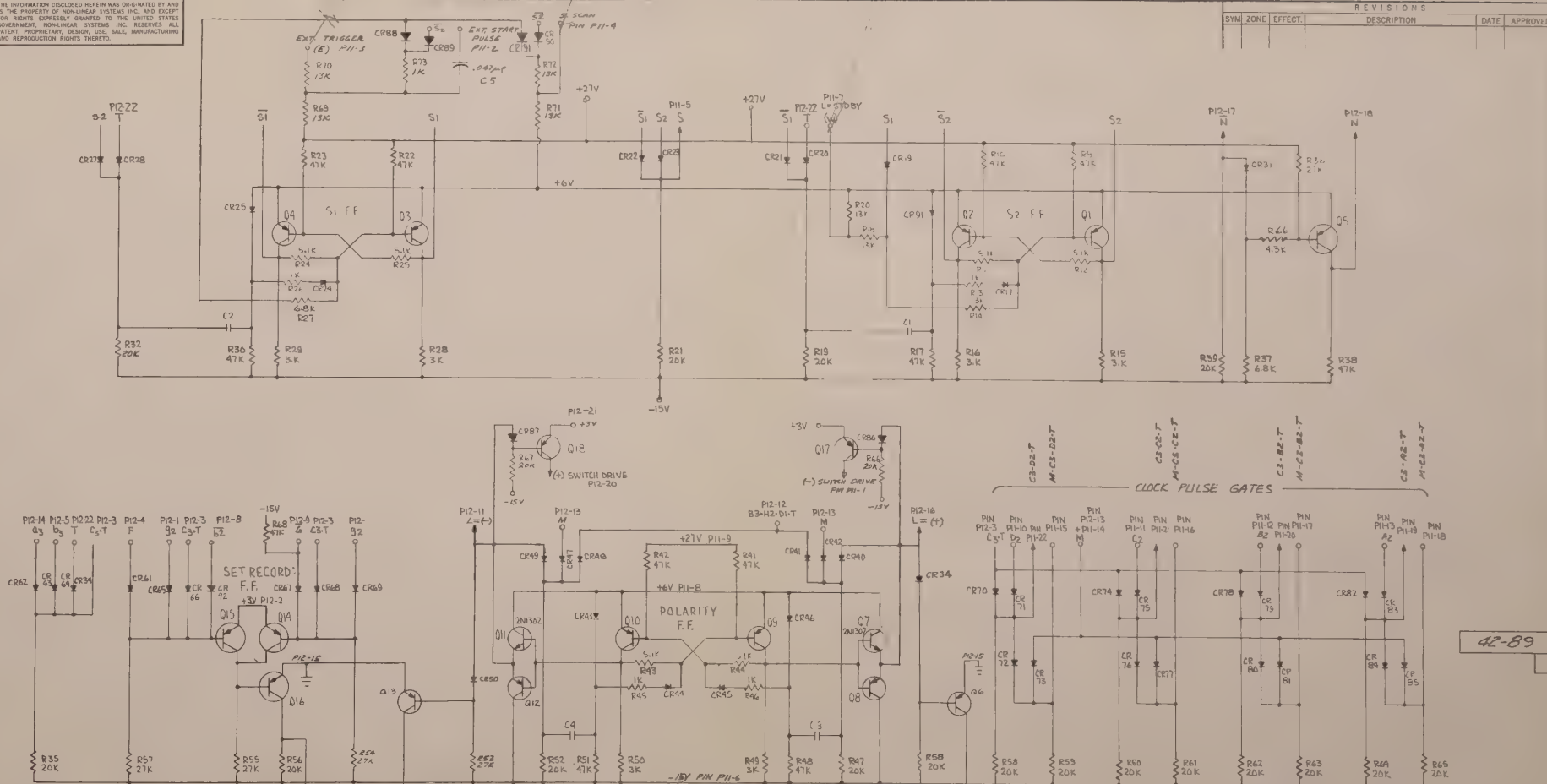


1. P0-00 = PIN NUMBERS  
NOTES: UNLESS OTHERWISE SPECIFIED.

| QTY REQD                         | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO. | FINL             | 42-86 | 57 | 1 | 1 |
|----------------------------------|-------------------------|-----------------------------|-----------|--------------|----------|------------------|-------|----|---|---|
| PARTS LIST                       |                         |                             |           |              |          | APPLICATION      |       |    |   |   |
| UNLESS OTHERWISE SPECIFIED       |                         |                             |           |              |          | NEXT ASSY.       |       |    |   |   |
| DIMENSIONS ARE IN INCHES         |                         |                             |           |              |          | FINAL ASSY.      |       |    |   |   |
| TOLERANCES ON                    |                         |                             |           |              |          | NEXT FINAL ASSY. |       |    |   |   |
| DECIMALS ± .010                  |                         |                             |           |              |          |                  |       |    |   |   |
| FRACTIONS ± 1/32                 |                         |                             |           |              |          |                  |       |    |   |   |
| SURFACE ROUGHNESS PER MIL-STD-10 |                         |                             |           |              |          |                  |       |    |   |   |
| DO NOT SCALE THIS DRAWING        |                         |                             |           |              |          |                  |       |    |   |   |
| RELEASE DATE 2-18-65             |                         |                             |           |              |          |                  |       |    |   |   |
| DRAWN by Deubers 1/22/65         |                         |                             |           |              |          |                  |       |    |   |   |
| CHECK by Trine 1-26-65           |                         |                             |           |              |          |                  |       |    |   |   |
| APPR by Hoffmeier 1-26-65        |                         |                             |           |              |          |                  |       |    |   |   |
| MATERIAL                         |                         |                             |           |              |          |                  |       |    |   |   |
| FINISH                           |                         |                             |           |              |          |                  |       |    |   |   |
| CODE IDENT NO. 03626             |                         |                             |           |              |          |                  |       |    |   |   |
| SIZE C                           |                         |                             |           |              |          |                  |       |    |   |   |
| SCALE                            |                         |                             |           |              |          |                  |       |    |   |   |
| WEIGHT                           |                         |                             |           |              |          |                  |       |    |   |   |
| SHEET 3                          |                         |                             |           |              |          |                  |       |    |   |   |



| REVISONS |      |        |             |      |
|----------|------|--------|-------------|------|
| SYM      | ZONE | EFFECT | DESCRIPTION | DATE |
|          |      |        |             |      |
|          |      |        |             |      |



42-89

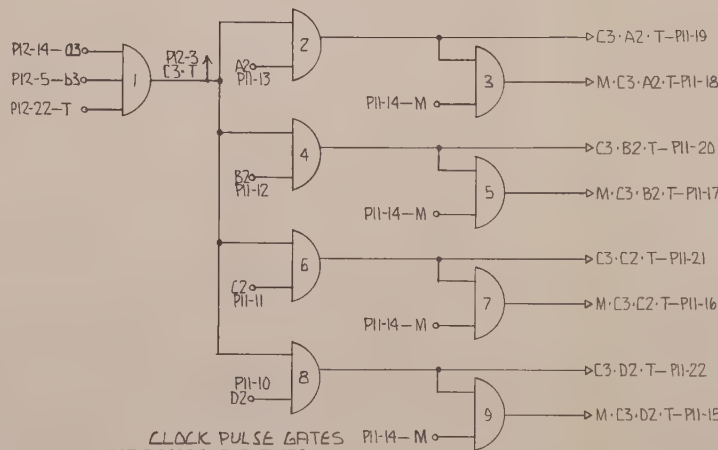
- A9 Q'S = TRANSISTORS (22)  
A9 C'S = CAPACITORS  
A9 R'S = RESISTORS (70)  
A9 C'S = DIODES  
5. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.  
4. ALL CAPACITORS 0.001UF, 1KV  
3. ALL TRANSISTORS 2N305  
2. ALL DIODES NLS 5003-002  
1. ALL RESISTORS 1/2W, 5% CARBON

NOTES: UNLESS OTHERWISE SPECIFIED

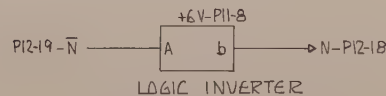
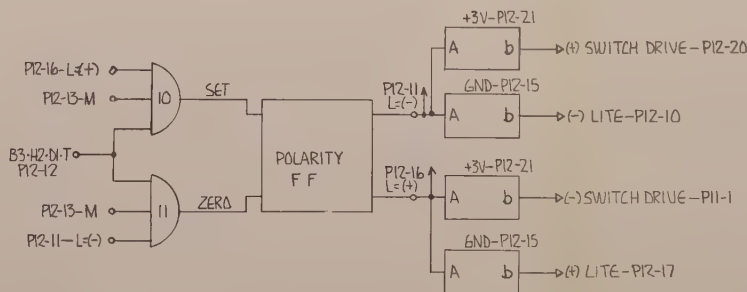
|                            |                         |                             |           |                                  |          |                                                                   |             |            |             |
|----------------------------|-------------------------|-----------------------------|-----------|----------------------------------|----------|-------------------------------------------------------------------|-------------|------------|-------------|
| QTY REQD                   | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF.                     | ITEM NO. | NEXT ASSY.                                                        | FINAL ASSY. | NEXT ASSY. | FINAL ASSY. |
| PARTS LIST                 |                         |                             |           |                                  |          |                                                                   |             |            |             |
| UNLESS OTHERWISE SPECIFIED |                         | DRAWN <i>Wolter</i>         |           | CHECKED <i>Wolter</i>            |          | NON-LINEAR SYSTEMS, INC.<br>DEL MAR, CALIFORNIA                   |             |            |             |
| DIMENSIONS ARE IN INCHES   |                         | TOLERANCES ON               |           | APPROX. <i>Hydram</i>            |          | SCHEMATIC DIAGRAM -<br>P9 SYNC AND POLARITY F.F.'S<br>SERIES 4200 |             |            |             |
| DECIMALS = .001            |                         | ANGLES = 90°                |           | MATERIAL                         |          | CODE IDENT NO. <b>03626</b> SIZE <b>D</b>                         |             |            |             |
| FRACTIONS = 1/32           |                         | FINISH                      |           | SURFACE ROUGHNESS PER MIL-STD-10 |          | RELEASE DATE <b>4-2-65</b>                                        |             |            |             |
| DO NOT SCALE THIS DRAWING  |                         | SCALE                       |           | WEIGHT                           |          | SHEET <b>2</b>                                                    |             |            |             |



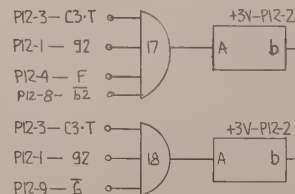
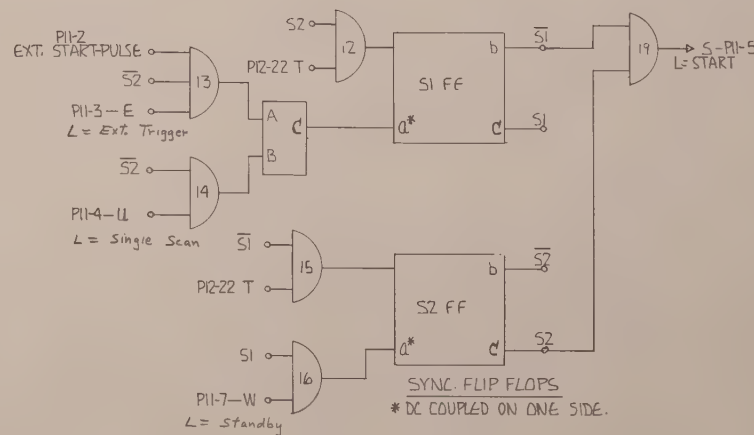
| REVISIONS |      |        |             |      |
|-----------|------|--------|-------------|------|
| SYM       | ZONE | EFFECT | DESCRIPTION | DATE |
|           |      |        |             |      |
|           |      |        |             |      |



CLOCK PULSE GATES  
FOR DECADE FLIP FLOPS



LOGIC INVERTER



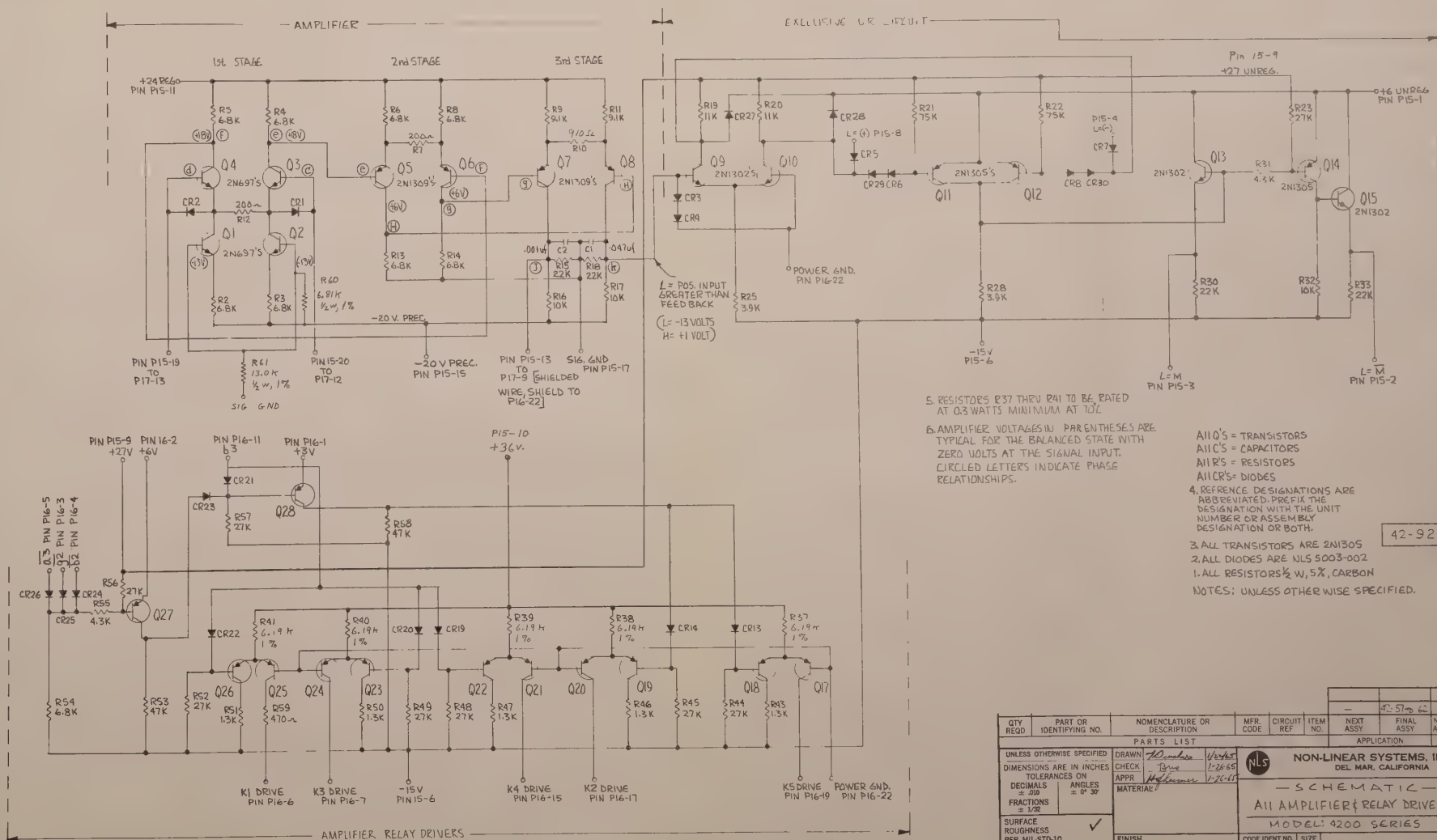
1. P12-00 = PIN NUMBERS  
NOTES: UNLESS OTHERWISE SPECIFIED.

| QTY REQD                             | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO. | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
|--------------------------------------|-------------------------|-----------------------------|-----------|--------------|----------|-------|-------|---------|---|---|
| PARTS LIST                           |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| UNLESS OTHERWISE SPECIFIED           |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| DIMENSIONS ARE IN INCHES             |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| TOLERANCES ON                        |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| DECIMALS ± .010                      |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| FRACTIONS ± 1/32                     |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| ANGLES ± 0° 30'                      |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| SURFACE ROUGHNESS PER MIL-STD-10     |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| DO NOT SCALE THIS DRAWING            |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| RELEASE DATE 2/18/65                 |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| DRAWN Deuchars 1-22-65               |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| CHECK Bone 1-26-65                   |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| APPR H. J. P. 1-26-65                |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| MATERIAL                             |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| SYNCH. POLARITY F.F.'S-BLOCK DIAGRAM |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| SERIES 4200                          |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| CODE IDENT NO. 03626                 |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| SIZE C                               |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| SCALE                                |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| WEIGHT                               |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |
| SHEET 3                              |                         |                             |           |              |          | FINAL | 42-89 | 60 ± 58 | 1 | 1 |



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| REVISIONS |      |         |             |      |          |
|-----------|------|---------|-------------|------|----------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE | APPROVED |
|           |      |         |             |      |          |



5. RESISTORS R37 THRU R41 TO BE RATED AT 0.3 WATTS MINIMUM AT 70°C

6. AMPLIFIER VOLTAGES IN PARENTHESES ARE TYPICAL FOR THE BALANCED STATE WITH ZERO VOLTS AT THE SIGNAL INPUT. CIRCLED LETTERS INDICATE PHASE RELATIONSHIPS.

All Q's = TRANSISTORS  
 All C's = CAPACITORS  
 All R's = RESISTORS  
 All CR's = DIODES

4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

3. ALL TRANSISTORS ARE 2N1305

2. ALL DIODES ARE NLS 5003-002  
1. ALL RESISTORS  $\frac{1}{2}$  W, 5%, CARBON

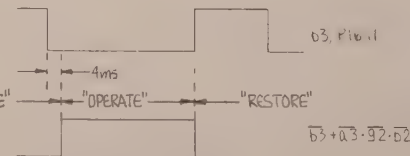
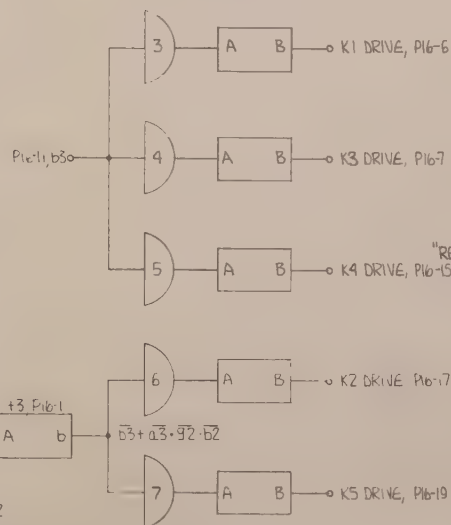
NOTES: UNLESS OTHERWISE SPECIFIED.

|                                                                   |  |                         |  |                             |  |                             |              |                               |           |                                                     |           |                |  |
|-------------------------------------------------------------------|--|-------------------------|--|-----------------------------|--|-----------------------------|--------------|-------------------------------|-----------|-----------------------------------------------------|-----------|----------------|--|
| QTY REQD                                                          |  | PART OR IDENTIFYING NO. |  | NOMENCLATURE OR DESCRIPTION |  | MFR. CODE                   | CIRCUIT REF. | ITEM NO.                      | NEXT ASSY | FINAL ASSY                                          | NEXT ASSY | FINAL ASSY     |  |
| PARTS LIST                                                        |  |                         |  |                             |  |                             |              |                               |           | APPLICATION QTY                                     |           |                |  |
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON |  |                         |  |                             |  | DRAWN BY <i>R. Anderson</i> |              | DATE <i>1/26/45</i>           |           | MLS NON-LINEAR SYSTEMS, INC.<br>DEL MAR, CALIFORNIA |           |                |  |
| DECIMALS ± .01                                                    |  |                         |  |                             |  | CHECKED BY <i>B. King</i>   |              | DATE <i>1-26-45</i>           |           |                                                     |           |                |  |
| FRACTIONS ± 1/32                                                  |  |                         |  |                             |  | APPR BY <i>H. J. Hansen</i> |              | DATE <i>1-26-45</i>           |           |                                                     |           |                |  |
| ANGLES ± 30°                                                      |  |                         |  |                             |  | MATERIAL:                   |              | — SCHEMATIC —                 |           |                                                     |           |                |  |
| SURFACE ROUGHNESS PER MIL-STD-10                                  |  |                         |  |                             |  | FINISH                      |              | ALL AMPLIFIER & RELAY DRIVERS |           |                                                     |           |                |  |
| DO NOT SCALE THIS DRAWING                                         |  |                         |  |                             |  |                             |              | MODEL: 4200 SERIES            |           |                                                     |           |                |  |
| RELEASE DATE <i>2/18/65</i>                                       |  |                         |  |                             |  |                             |              | CODE IDENT NO. <b>03626</b>   |           | SIZE <b>D</b>                                       |           | <b>42-92</b>   |  |
|                                                                   |  |                         |  |                             |  |                             |              | SCALE                         |           | WEIGHT                                              |           | SHEET <b>2</b> |  |

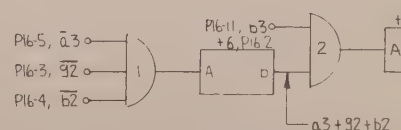


| REVISIONS |      |        |             |      |
|-----------|------|--------|-------------|------|
| SYM       | ZONE | EFFECT | DESCRIPTION | DATE |
|           |      |        |             |      |
|           |      |        |             |      |

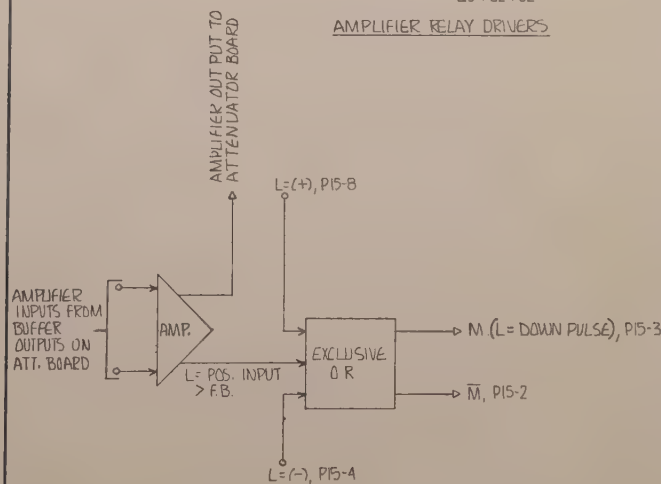
CONSTANT CURRENT DRIVES, L = RELAY DE-ENERGIZED



RELAY TIMING DIAGRAM



AMPLIFIER RELAY DRIVERS

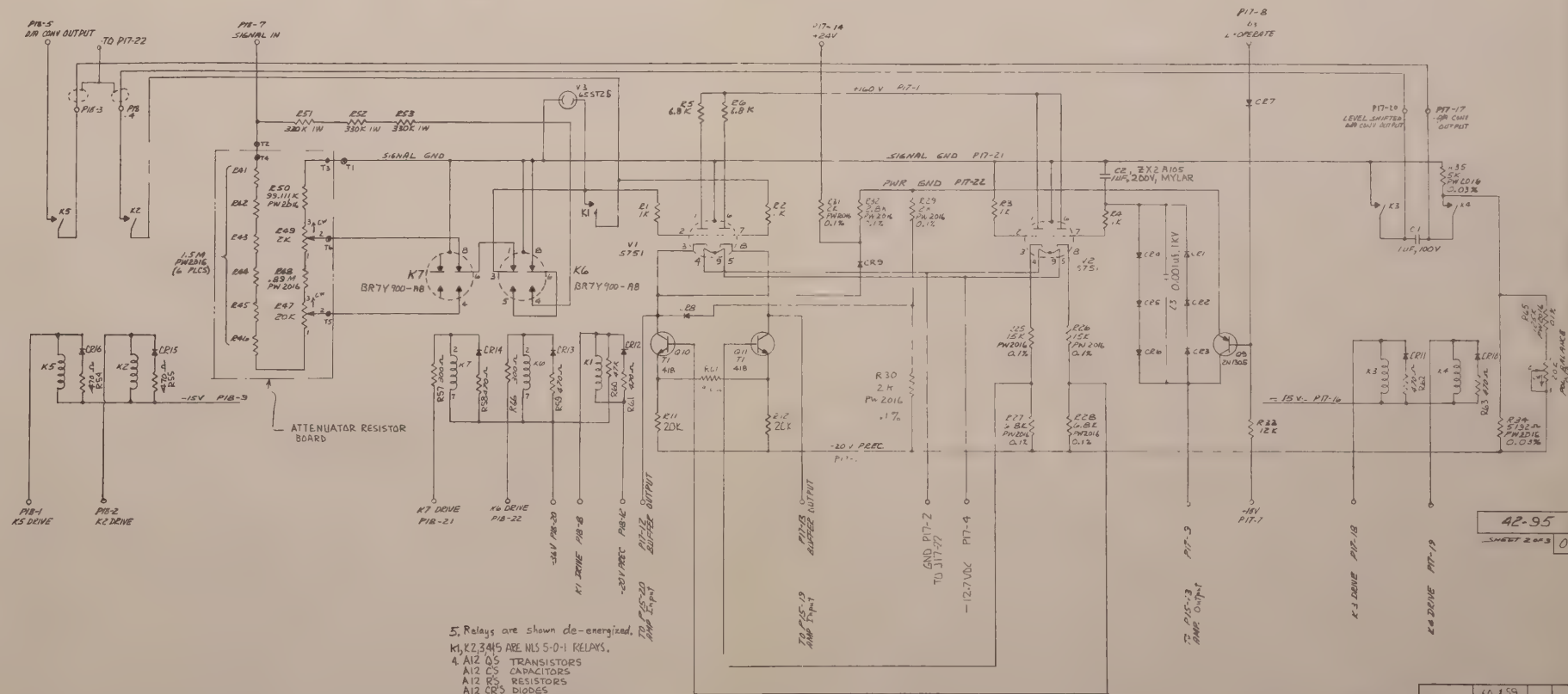


42-92 Ser 3

|                                  |                         |                             |           |              |          |                                         |       |   |   |
|----------------------------------|-------------------------|-----------------------------|-----------|--------------|----------|-----------------------------------------|-------|---|---|
| QTY REQD                         | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO. | FINAL                                   | 42-92 | 1 | 1 |
| PARTS LIST                       |                         |                             |           |              |          | APPLICATION                             |       |   |   |
| UNLESS OTHERWISE SPECIFIED       |                         |                             |           |              |          | NEXT ASSY.                              |       |   |   |
| DIMENSIONS ARE IN INCHES         |                         |                             |           |              |          | FINAL ASSY.                             |       |   |   |
| TOLERANCES ON                    |                         |                             |           |              |          | NEXT ASSY.                              |       |   |   |
| DECIMALS ± .010                  |                         |                             |           |              |          | QTY.                                    |       |   |   |
| FRACTIONS ± 1/32                 |                         |                             |           |              |          | APPLICATION                             |       |   |   |
| ANGLES = 0° 30'                  |                         |                             |           |              |          | QTY.                                    |       |   |   |
| SURFACE ROUGHNESS PER MIL-STD-10 |                         |                             |           |              |          | APPLICATION                             |       |   |   |
| DO NOT SCALE THIS DRAWING        |                         |                             |           |              |          | QTY.                                    |       |   |   |
| RELEASE DATE 2/18/65             |                         |                             |           |              |          | QTY.                                    |       |   |   |
| DRAWN Deuchars 1-22-65           |                         |                             |           |              |          | NON-LINEAR SYSTEMS, INC.                |       |   |   |
| CHECK Dwyer 1-26-65              |                         |                             |           |              |          | DEL MAR, CALIFORNIA                     |       |   |   |
| APPR H. J. Hanna 1-26-65         |                         |                             |           |              |          | AMPLIFIER, RELAY DRIVERS; BLOCK DIAGRAM |       |   |   |
| MATERIAL                         |                         |                             |           |              |          | SERIES 4200                             |       |   |   |
| FINISH                           |                         |                             |           |              |          | CODE IDENT NO. 03626                    |       |   |   |
| SIZE C                           |                         |                             |           |              |          | 42-92                                   |       |   |   |
| SCALE                            |                         |                             |           |              |          | WEIGHT                                  |       |   |   |
| SHEET 3                          |                         |                             |           |              |          | SHEET 3                                 |       |   |   |



| REVISIONS |      |        |             |      |
|-----------|------|--------|-------------|------|
| SYM       | ZONE | EFFECT | DESCRIPTION | DATE |
|           |      |        |             |      |



5. Relays are shown de-energized.  
 K1, K2, K3, K4, K5 ARE NLS 5-0-1 RELAYS.  
 4. A12 Q5 TRANSISTORS  
 A12 C5 CAPACITORS  
 A12 R5 RESISTORS  
 A12 CR5 DIODES  
 3. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.  
 2. ALL DIODES ARE NLS 5003-002.  
 1. ALL RESISTORS  $\frac{1}{2}$  W, 5%, CARBON.  
 NOTES: UNLESS OTHERWISE SPECIFIED.

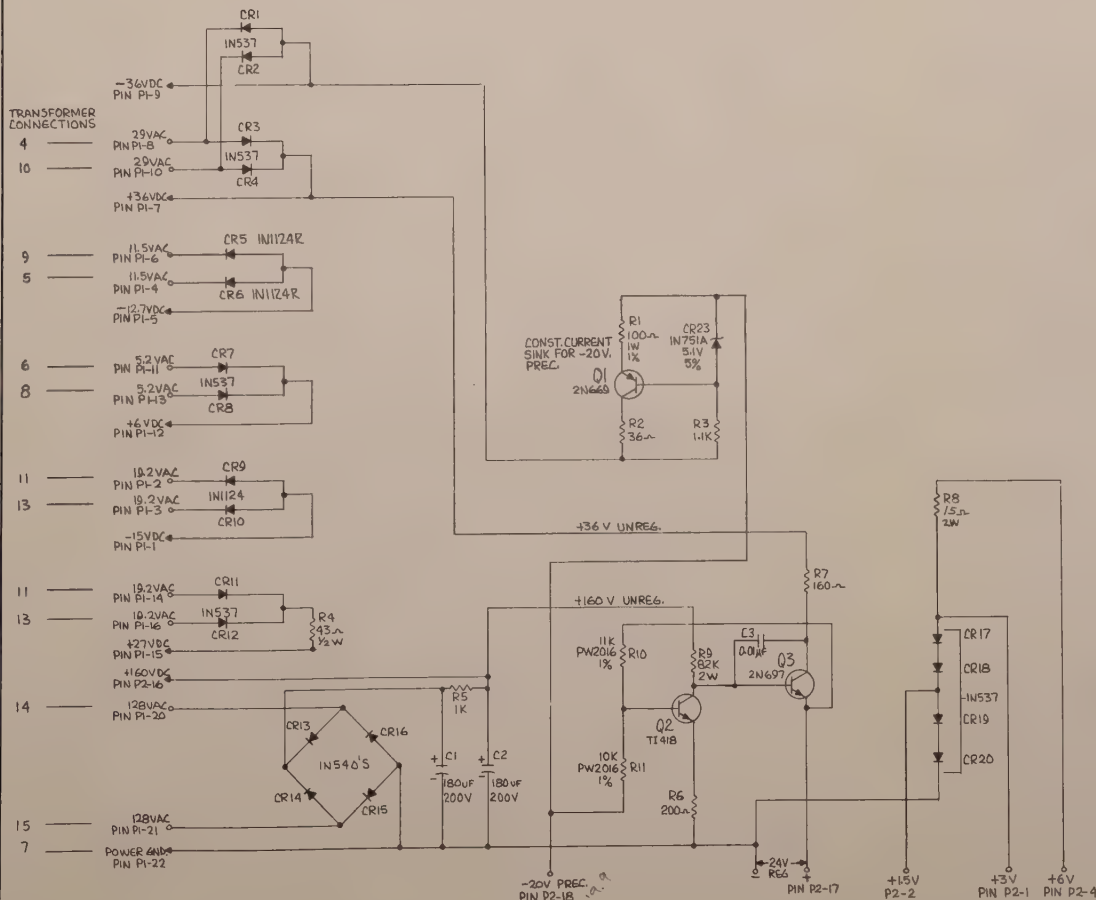
42-95  
 SHEET 2 OF 3

| QTY REQD                                                                                      | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO. | NEXT ASSY | FINAL ASSY | NEXT FINAL ASSY |
|-----------------------------------------------------------------------------------------------|-------------------------|-----------------------------|-----------|--------------|----------|-----------|------------|-----------------|
| PARTS LIST                                                                                    |                         |                             |           |              |          |           |            |                 |
| UNLESS OTHERWISE SPECIFIED                                                                    |                         |                             |           |              |          |           |            |                 |
| DIMENSIONS ARE IN INCHES                                                                      |                         |                             |           |              |          |           |            |                 |
| TOLERANCES ON                                                                                 |                         |                             |           |              |          |           |            |                 |
| DECIMALS                                                                                      |                         |                             |           |              |          |           |            |                 |
| FRACTIONS                                                                                     |                         |                             |           |              |          |           |            |                 |
| SURFACE ROUGHNESS PER MIL-STD-10                                                              |                         |                             |           |              |          |           |            |                 |
| DO NOT SCALE THIS DRAWING                                                                     |                         |                             |           |              |          |           |            |                 |
| RELEASE DATE                                                                                  |                         |                             |           |              |          |           |            |                 |
| DRAWN: <i>W. H. H.</i> CHECK: <i>W. H. H.</i> APPR: <i>W. H. H.</i> MATERIAL: <i>W. H. H.</i> |                         |                             |           |              |          |           |            |                 |
| FINISH                                                                                        |                         |                             |           |              |          |           |            |                 |
| CODE IDENT NO. SIZE                                                                           |                         |                             |           |              |          |           |            |                 |
| 03626 D 42-95                                                                                 |                         |                             |           |              |          |           |            |                 |
| SCALE WEIGHT SHEET 2                                                                          |                         |                             |           |              |          |           |            |                 |

42-95  
 42-62, 61  
 42-61, 60  
 42-60, 59  
 42-59, 58  
 42-58, 57  
 42-57, 56  
 42-56, 55  
 42-55, 54  
 42-54, 53  
 42-53, 52  
 42-52, 51  
 42-51, 50  
 42-50, 49  
 42-49, 48  
 42-48, 47  
 42-47, 46  
 42-46, 45  
 42-45, 44  
 42-44, 43  
 42-43, 42  
 42-42, 41  
 42-41, 40  
 42-40, 39  
 42-39, 38  
 42-38, 37  
 42-37, 36  
 42-36, 35  
 42-35, 34  
 42-34, 33  
 42-33, 32  
 42-32, 31  
 42-31, 30  
 42-30, 29  
 42-29, 28  
 42-28, 27  
 42-27, 26  
 42-26, 25  
 42-25, 24  
 42-24, 23  
 42-23, 22  
 42-22, 21  
 42-21, 20  
 42-20, 19  
 42-19, 18  
 42-18, 17  
 42-17, 16  
 42-16, 15  
 42-15, 14  
 42-14, 13  
 42-13, 12  
 42-12, 11  
 42-11, 10  
 42-10, 9  
 42-9, 8  
 42-8, 7  
 42-7, 6  
 42-6, 5  
 42-5, 4  
 42-4, 3  
 42-3, 2  
 42-2, 1  
 42-1, 0



| REVISIONS |      |        |             |      |
|-----------|------|--------|-------------|------|
| SYM       | ZONE | EFFECT | DESCRIPTION | DATE |
|           |      |        |             |      |



AI Q'S = TRANSISTORS  
AI C'S = CAPACITORS  
AI R'S = RESISTORS  
AI CR'S = DIODES

4 REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

3 ALL TRANSISTORS ARE 2N1305

2 ALL DIODES ARE 1N537 - ...

1 ALL RESISTORS ARE 1/2W 5% CARBON

NOTES: UNLESS OTHERWISE SPECIFIED,

42-96 SH2

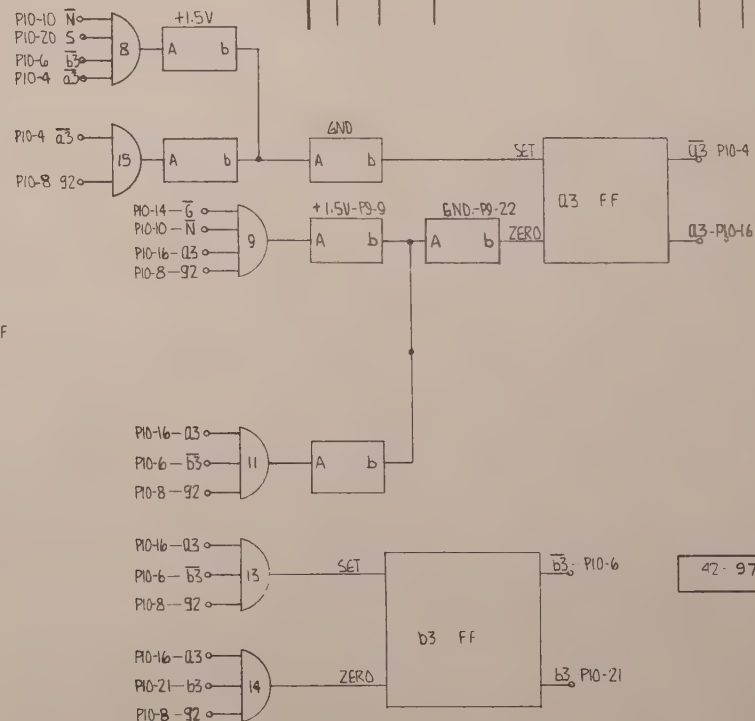
|                                  |                         |                                       |           |                                       |          |                                                 |          |         |   |
|----------------------------------|-------------------------|---------------------------------------|-----------|---------------------------------------|----------|-------------------------------------------------|----------|---------|---|
| QTY. REQD.                       | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION           | MFR. CODE | CIRCUIT REF.                          | ITEM NO. | FINAL ASSY.                                     | 42-96457 | 1       | 1 |
| UNLESS OTHERWISE SPECIFIED:      |                         | DRAWN: <i>Decker</i> / <i>12/1/65</i> |           | CHECK: <i>Decker</i> / <i>1/26/66</i> |          | NON-LINEAR SYSTEMS, INC.<br>DEL MAR, CALIFORNIA |          |         |   |
| DIMENSIONS ARE IN INCHES         |                         | TOLERANCES ON DECIMALS ± .010         |           | ANGLES ± 0° 30'                       |          | —SCHEMATIC DIAGRAM—                             |          |         |   |
| SURFACE ROUGHNESS PER MIL-STD-10 |                         | FINISH                                |           | CODE IDENT NO. SIZE                   |          | MODEL: 4200 SERIES                              |          |         |   |
| DO NOT SCALE THIS DRAWING        |                         | RELEASE DATE: 2/18/65                 |           | SCALE                                 |          | WEIGHT                                          |          | SHEET 2 |   |







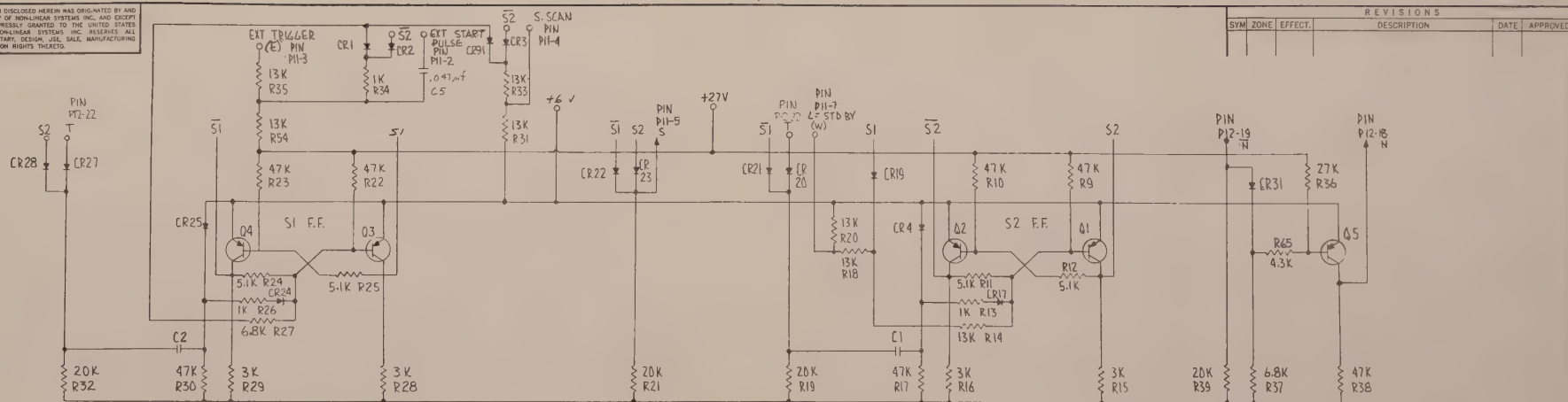
Hand-drawn logic diagram for a SET FF circuit. The circuit consists of three 7400 NAND gates (labeled A and b) and one 7402 NOR gate (labeled A and b). Inputs include P10-10 ( $\bar{N}$ ), P10-4 ( $a_3$ ), P10-6 ( $b_3$ ), P10-18 ( $A_2$ ), P10-17 ( $A_1$ ), P9-4 ( $a_1$ ), P9-5 ( $T$ ), P10-4 ( $\bar{a}_3$ ), P10-6 ( $\bar{b}_3$ ), and P10-20 ( $S$ ). Power supplies are +6V P9-10, +1.5V, and GND P9-22. The output is SET a1 FF P9-3.

DIETRICH-POST CLEARPRINT 10004-10



# REVISIONS

| SYM | ZONE | EFFECT | DESCRIPTION | DATE | APPROVED |
|-----|------|--------|-------------|------|----------|
|     |      |        |             |      |          |

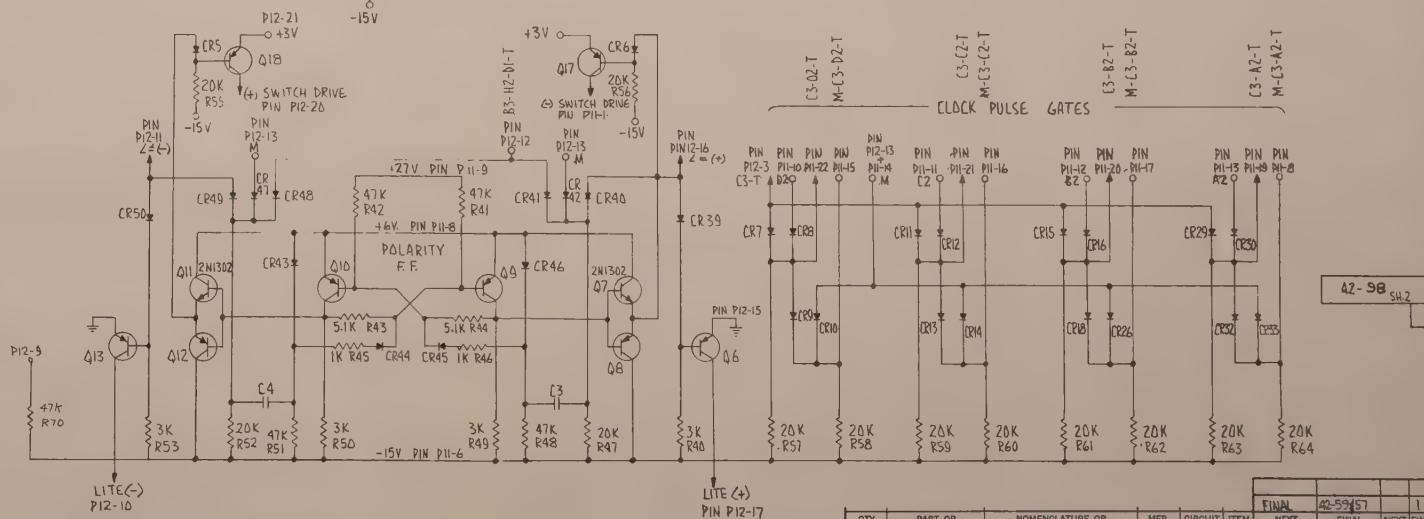


A9 Q'S = TRANSISTORS  
A9 C'S = CAPACITORS  
A9 R'S = RESISTORS  
A9 CR'S = DIODES

5 REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

- ALL TRANSISTORS 2N1305
- ALL DIODES NLS 5003-002
- ALL CAPACITORS 0.001  $\mu$ F, 10%, 1KV
- ALL RESISTORS  $\frac{1}{2}$ W, 5%, CARBON

NOTES: UNLESS OTHERWISE SPECIFIED,



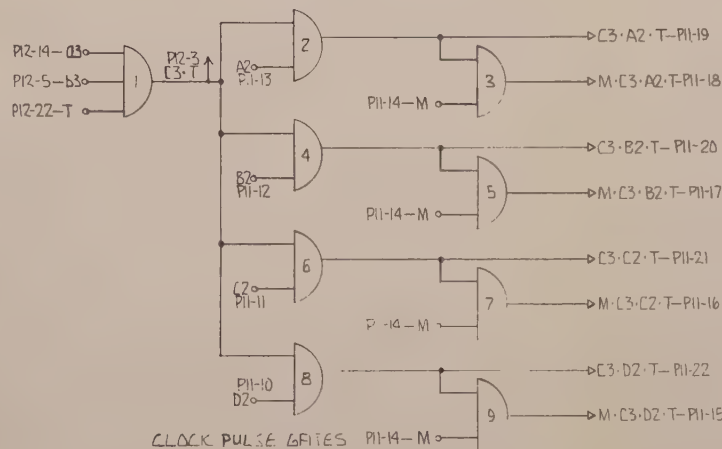
42-98 SH.2

|                            |                         |                             |           |              |          |                                   |       |    |   |
|----------------------------|-------------------------|-----------------------------|-----------|--------------|----------|-----------------------------------|-------|----|---|
| QTY REQD                   | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO. | FINAL                             | 42-98 | 51 | 1 |
| PARTS LIST                 |                         |                             |           |              |          | APPLICATION                       |       |    |   |
| UNLESS OTHERWISE SPECIFIED |                         |                             |           |              |          | NLS                               |       |    |   |
| DIMENSIONS ARE IN INCHES   |                         |                             |           |              |          | NON-LINEAR SYSTEMS, INC.          |       |    |   |
| TOLERANCES ON              |                         |                             |           |              |          | DEL MAR, CALIFORNIA               |       |    |   |
| DECIMALS                   |                         |                             |           |              |          | DRAWN: <i>Handwritten</i> 1/22/65 |       |    |   |
| ANGLES                     |                         |                             |           |              |          | APPR: <i>Handwritten</i> 1-26-65  |       |    |   |
| FRACTIONS                  |                         |                             |           |              |          | MATERIAL                          |       |    |   |
| SURFACE ROUGHNESS          |                         |                             |           |              |          | FINISH                            |       |    |   |
| PER MIL-STD-10             |                         |                             |           |              |          | CODE IDENT NO. SIZE               |       |    |   |
| DO NOT SCALE THIS DRAWING  |                         |                             |           |              |          | 03626 D                           |       |    |   |
| RELEASE DATE 2/18/65       |                         |                             |           |              |          | 42-98                             |       |    |   |
| SCALE                      |                         |                             |           |              |          | WEIGHT                            |       |    |   |
| SHEET 2 OF 3               |                         |                             |           |              |          |                                   |       |    |   |

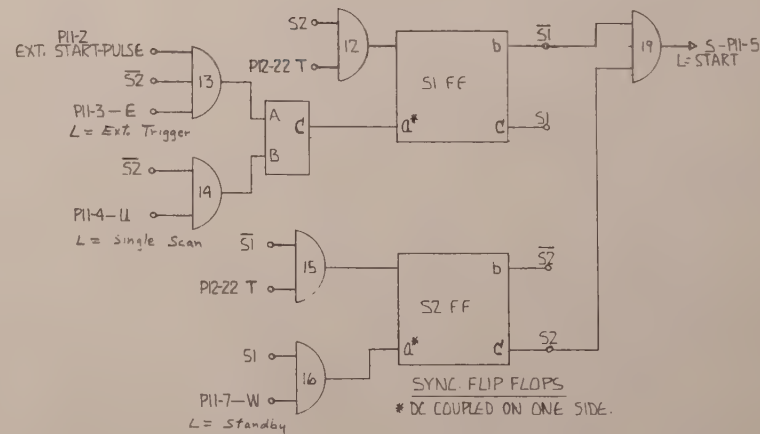
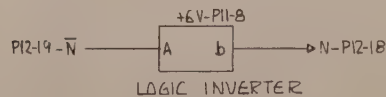
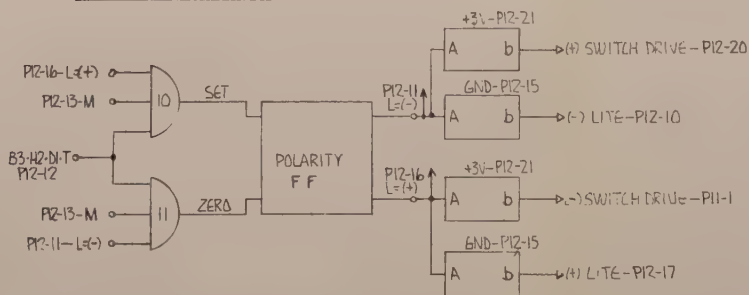


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| REVISIONS |      |         |             |               |
|-----------|------|---------|-------------|---------------|
| SYM       | ZONE | EFFECT. | DESCRIPTION | DATE APPROVED |



CLOCK PULSE GATES P11-14-M  
FOR DECADE FLIP FLOPS



SYNC. FLIP FLOPS  
\* DC COUPLED ON ONE SIDE.

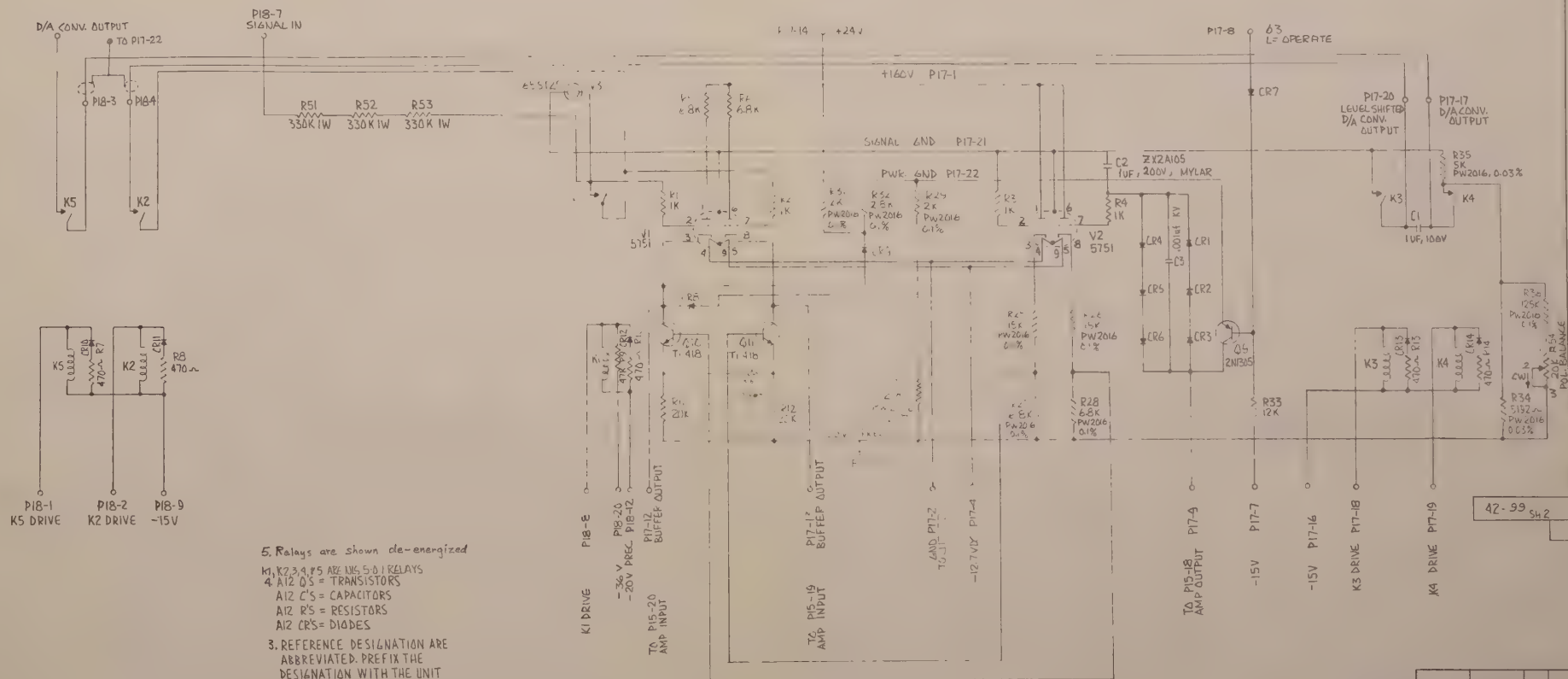
42-98 SH3

1. P10-00 = PIN NUMBERS  
NOTES: UNLESS OTHERWISE SPECIFIED.

| QTY REQD                   |  | PART OR IDENTIFYING NO. |  | NOMENCLATURE OR DESCRIPTION |  | MFR. CODE                   | CIRCUIT REF. | ITEM NO.                    | NEXT ASSY. |                  | FINAL ASSY. |                    | NEXT FINAL ASSY. |                                      |  |
|----------------------------|--|-------------------------|--|-----------------------------|--|-----------------------------|--------------|-----------------------------|------------|------------------|-------------|--------------------|------------------|--------------------------------------|--|
| PARTS LIST                 |  |                         |  |                             |  |                             |              |                             |            | APPLICATION      |             |                    |                  | QTY.                                 |  |
| UNLESS OTHERWISE SPECIFIED |  |                         |  |                             |  | DRAWN <i>J.D. ...</i>       |              | CHECK <i>B...</i>           |            | APPR <i>H...</i> |             | MATERIAL           |                  | NLS                                  |  |
| DIMENSIONS ARE IN INCHES   |  |                         |  |                             |  | TOLERANCES ON               |              | DECIMALS ± .010             |            | ANGLES ± 0° 30'  |             | FRACTIONS ± 1/32   |                  | SURFACE ROUGHNESS PER MIL-STD-10     |  |
| DO NOT SCALE THIS DRAWING  |  |                         |  |                             |  | RELEASE DATE <i>2/18/65</i> |              | CODE IDENT NO. <b>03626</b> |            | SIZE <b>C</b>    |             | SERIES <b>4200</b> |                  | SYNCH. POLARITY F.F.'S-BLOCK DIAGRAM |  |
| SCALE                      |  |                         |  |                             |  | WEIGHT                      |              | SHEET <b>3</b>              |            | 42-98            |             |                    |                  |                                      |  |



| REVISIONS |      |        |             |      |
|-----------|------|--------|-------------|------|
| SYM       | ZONE | EFFECT | DESCRIPTION | DATE |
|           |      |        |             |      |
|           |      |        |             |      |



5. Relays are shown de-energized  
 1. K1, K2, K3, K4, K5 ARE 12VDC RELAYS  
 4. A12 Q'S = TRANSISTORS  
 A12 C'S = CAPACITORS  
 A12 R'S = RESISTORS  
 A12 CR'S = DIODES  
 3. REFERENCE DESIGNATION ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.  
 2. ALL RESISTORS 1/2W, 5% CARBON  
 1. ALL DIODES NLS 5003-002

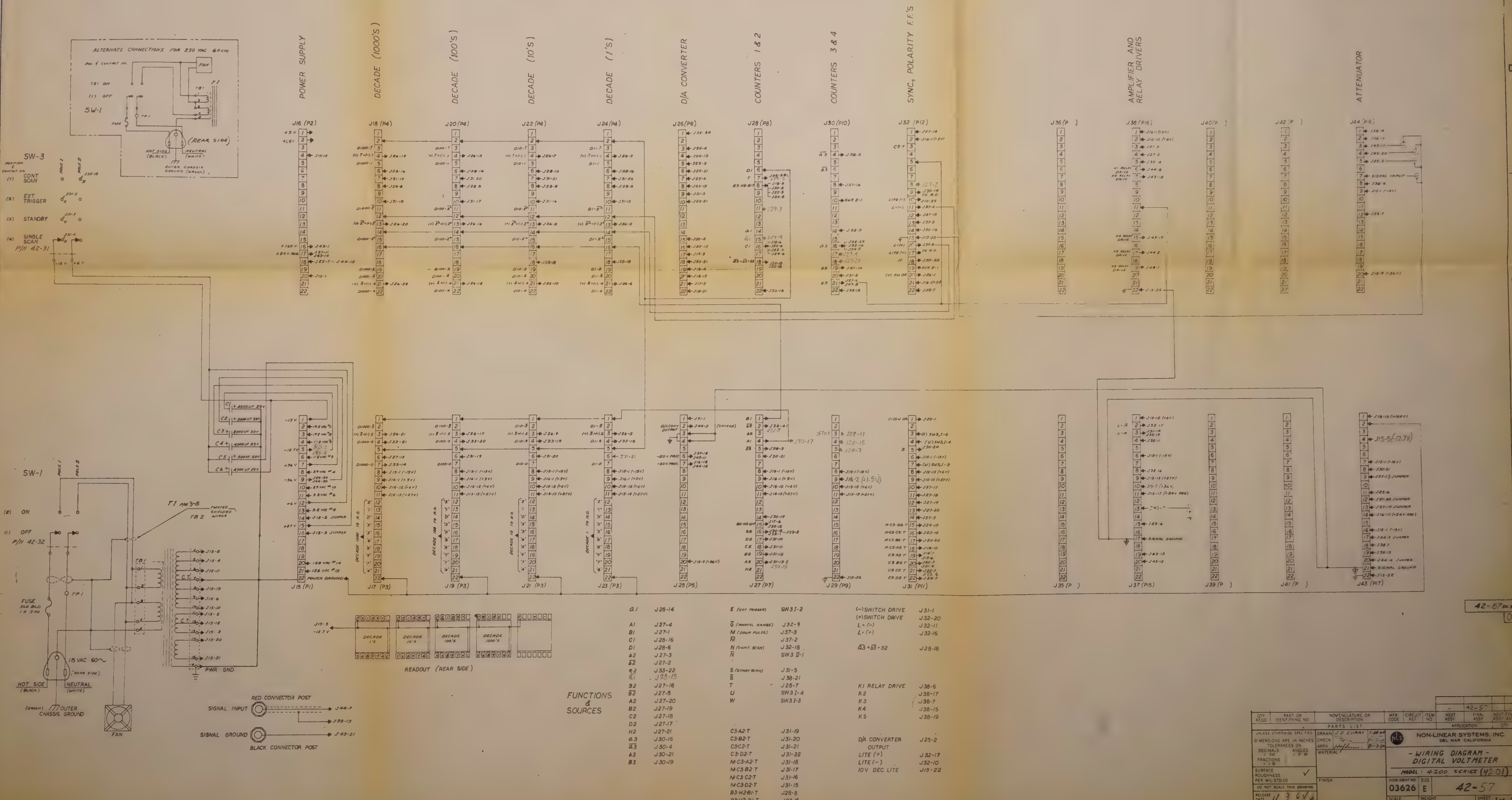
NOTES: UNLESS OTHERWISE SPECIFIED.

| QTY REQD                                                                         | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR CODE | CIRCUIT REF. | ITEM NO. | NEXT ASSY. | FINAL ASSY. | NEXT FINAL ASSY. | QTY. |
|----------------------------------------------------------------------------------|-------------------------|-----------------------------|----------|--------------|----------|------------|-------------|------------------|------|
| PARTS LIST                                                                       |                         |                             |          |              |          |            |             |                  |      |
| UNLESS OTHERWISE SPECIFIED                                                       |                         |                             |          |              |          |            |             |                  |      |
| DIMENSIONS ARE IN INCHES                                                         |                         |                             |          |              |          |            |             |                  |      |
| TOLERANCES ON                                                                    |                         |                             |          |              |          |            |             |                  |      |
| DECIMALS                                                                         |                         |                             |          |              |          |            |             |                  |      |
| FRACTIONS                                                                        |                         |                             |          |              |          |            |             |                  |      |
| SURFACE ROUGHNESS PER MIL-STD-10                                                 |                         |                             |          |              |          |            |             |                  |      |
| DO NOT SCALE THIS DRAWING                                                        |                         |                             |          |              |          |            |             |                  |      |
| RELEASE DATE                                                                     |                         |                             |          |              |          |            |             |                  |      |
| DRAWN BY: <i>W. J. JONES</i> CHECKED BY: <i>W. J. JONES</i> DATE: <i>1-26-65</i> |                         |                             |          |              |          |            |             |                  |      |
| MATERIAL: <i>W. J. JONES</i>                                                     |                         |                             |          |              |          |            |             |                  |      |
| FINISH                                                                           |                         |                             |          |              |          |            |             |                  |      |
| CODE IDENT NO. SIZE                                                              |                         |                             |          |              |          |            |             |                  |      |
| 03626 D                                                                          |                         |                             |          |              |          |            |             |                  |      |
| SCALE WEIGHT                                                                     |                         |                             |          |              |          |            |             |                  |      |
| SHEET 2                                                                          |                         |                             |          |              |          |            |             |                  |      |

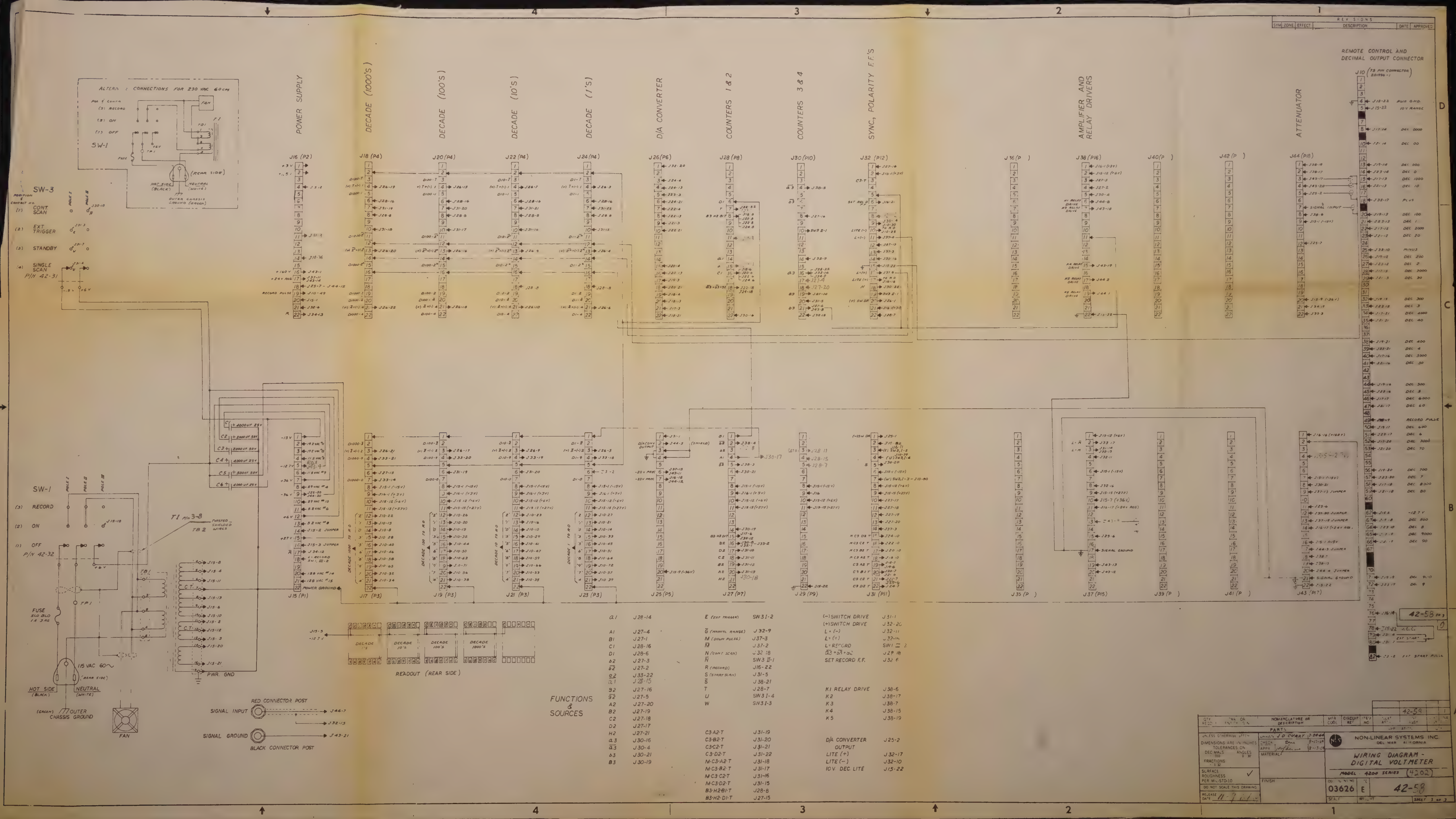
NON-LINEAR SYSTEMS, INC.  
 DEL MAR, CALIFORNIA  
 - SCHEMATIC DIAGRAM -  
 A12 ATTENUATOR  
 MODEL: 4200 SERIES

42-99

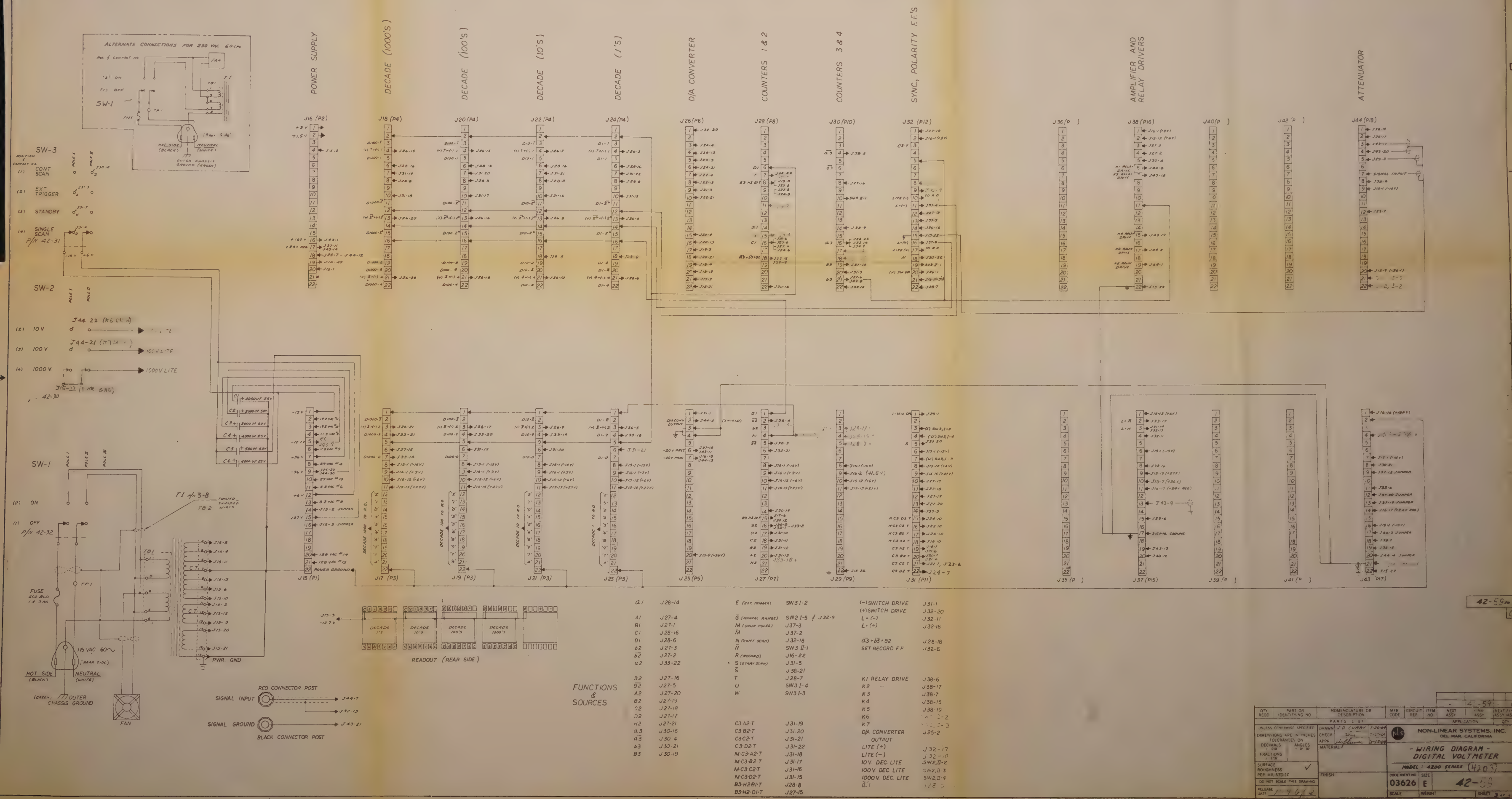






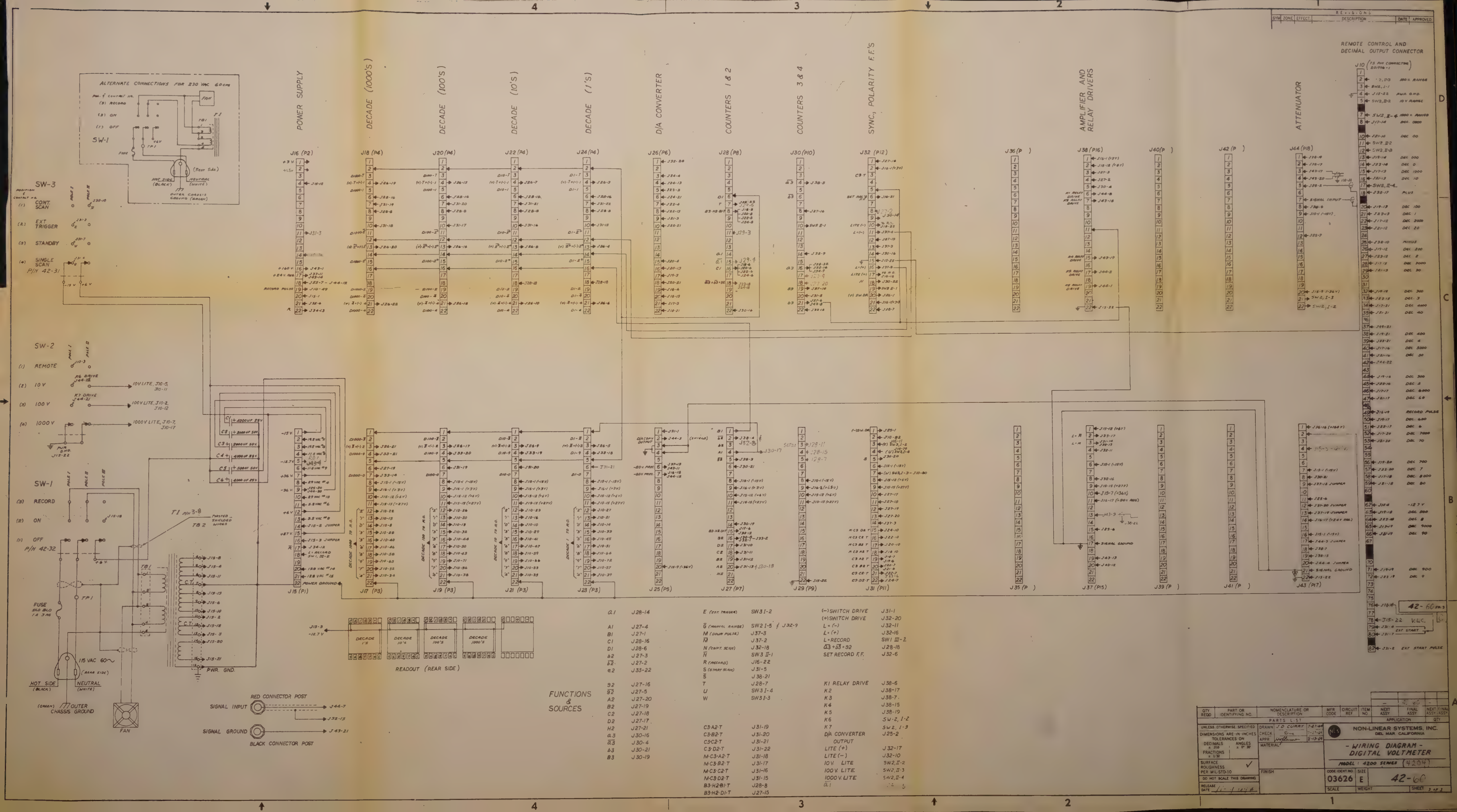




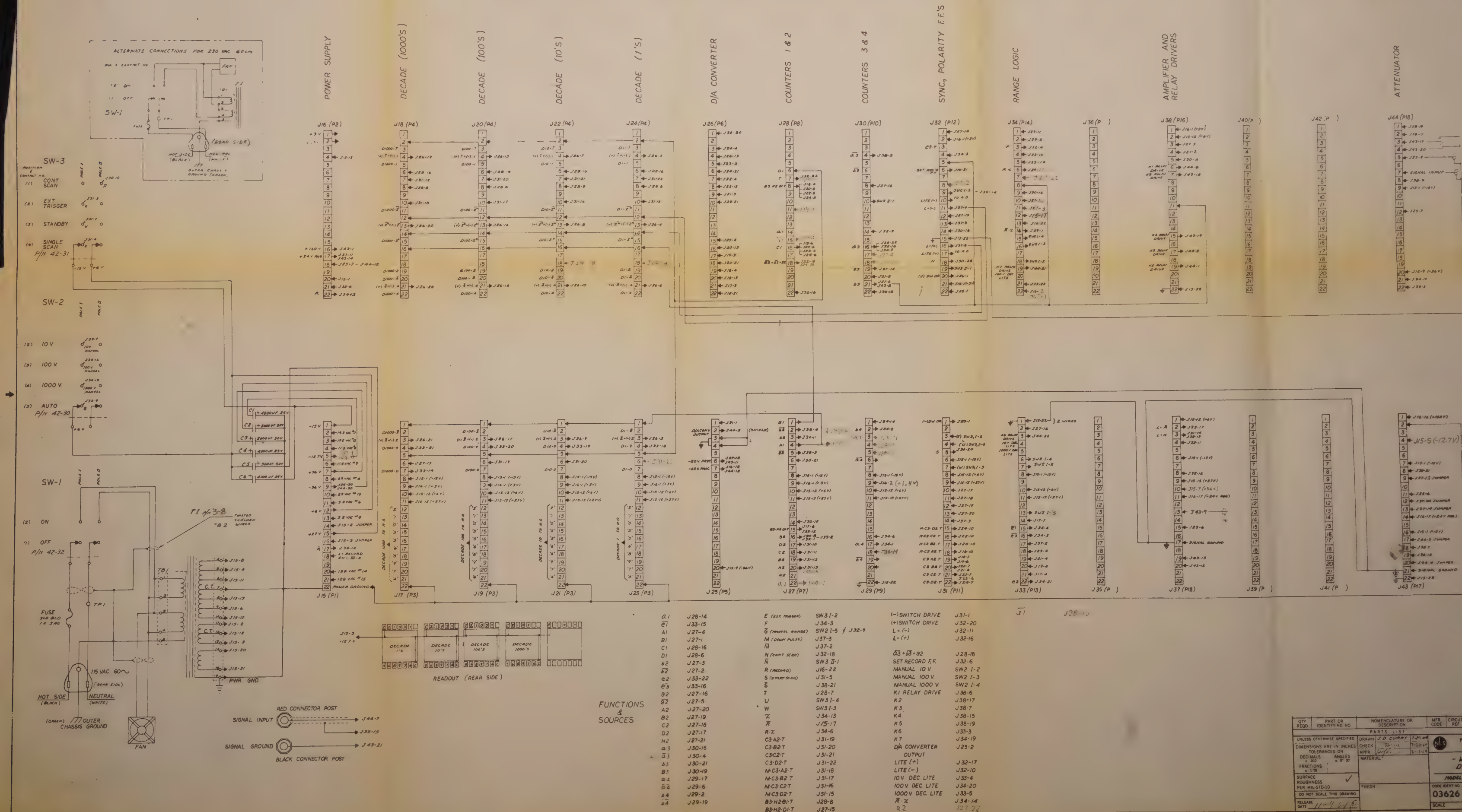


| QTY                                                                                                                                      | RECD | PART OR IDENTIFYING NO | NOMENCLATURE OR DESCRIPTION | MFR CODE | CIRCUIT REF | ITEM NO | TEST ASSY | FINAL ASSY | INSTRUMENTAL ASSY | QTY |
|------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------|-----------------------------|----------|-------------|---------|-----------|------------|-------------------|-----|
| PARTS LIST                                                                                                                               |      |                        |                             |          |             |         |           |            |                   |     |
| UNLESS OTHERWISE SPECIFIED: DRAWN: J.D. CLARK, 7-20-64, CHECKED: J.D. CLARK, 7-20-64, APPR: J.D. CLARK, 7-20-64, MATERIAL: 1/2" ALUMINUM |      |                        |                             |          |             |         |           |            |                   |     |
| DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS: .010 ANGLES: 1/2" SURFACE: 1/2" FINISH: 1/2" DO NOT SCALE THIS DRAWING                  |      |                        |                             |          |             |         |           |            |                   |     |
| RELEASE DATE: 7-20-64                                                                                                                    |      |                        |                             |          |             |         |           |            |                   |     |
| NON-LINEAR SYSTEMS, INC. DEL MAR, CALIFORNIA                                                                                             |      |                        |                             |          |             |         |           |            |                   |     |
| - WIRING DIAGRAM - DIGITAL VOLTMETER                                                                                                     |      |                        |                             |          |             |         |           |            |                   |     |
| MODEL: 4200 SERIES (4203)                                                                                                                |      |                        |                             |          |             |         |           |            |                   |     |
| CODE IDENT NO: 03626 E SIZE: 42-59                                                                                                       |      |                        |                             |          |             |         |           |            |                   |     |
| SCALE: WEIGHT: SHEET: 3 of 3                                                                                                             |      |                        |                             |          |             |         |           |            |                   |     |



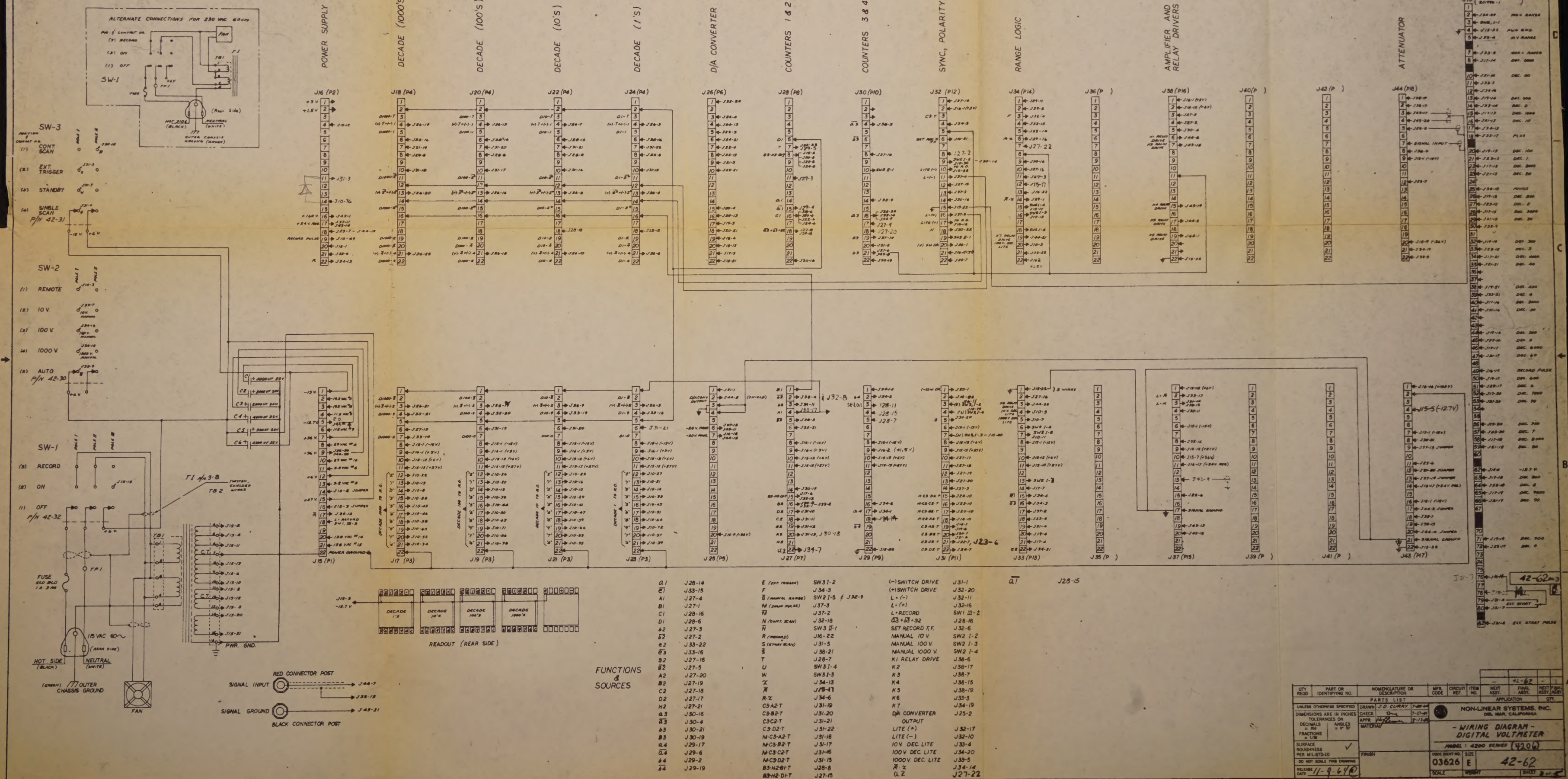






| QTY                              | PART OR IDENTIFYING NO | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF               | ITEM NO     | NET ASST            | FINAL ASST | NET/FINAL ASST |
|----------------------------------|------------------------|-----------------------------|-----------|---------------------------|-------------|---------------------|------------|----------------|
|                                  |                        | PARTS LIST                  |           |                           | APPLICATION |                     | QTY        |                |
| UNLESS OTHERWISE SPECIFIED       |                        | DRAWN <u>J D CURRY</u>      |           | NON-LINEAR SYSTEMS, INC.  |             |                     |            |                |
| DIMENSIONS ARE IN INCHES         |                        | CHECKED <u>JD</u>           |           | DEL. MAR. CALIFORNIA      |             |                     |            |                |
| TOLERANCES ON                    |                        | APPR <u>JD</u>              |           | - WIRING DIAGRAM -        |             |                     |            |                |
| DECIMALS ANGLES                  |                        | MATERIAL                    |           | DIGITAL VOLTMETER         |             |                     |            |                |
| 0.005 0° 30'                     |                        |                             |           | MODEL: 4200 SERIES (4205) |             |                     |            |                |
| FRACTIONS 1/32                   |                        |                             |           | SIZE                      |             |                     |            |                |
| SURFACE ROUGHNESS PER MIL-STD-10 |                        | FINISH                      |           | CODE IDENT NO             |             |                     |            |                |
| ✓                                |                        |                             |           | 03626                     |             | 42-61               |            |                |
| DO NOT SCALE THIS DRAWING        |                        |                             |           | SCALE                     |             | WEIGHT              |            |                |
| RELEASE DATE <u>11-9-68</u>      |                        |                             |           |                           |             | SHEET <u>3 of 4</u> |            |                |







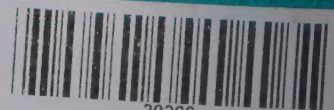


non | linear  
 systems, inc.  
DEL MAR, CALIFORNIA

MP MASTER



MA33777



20266